



Technology in the Trades—3D Laser Scanning

Scanning the USS



Matthew Marchese (Ap, LU 638)

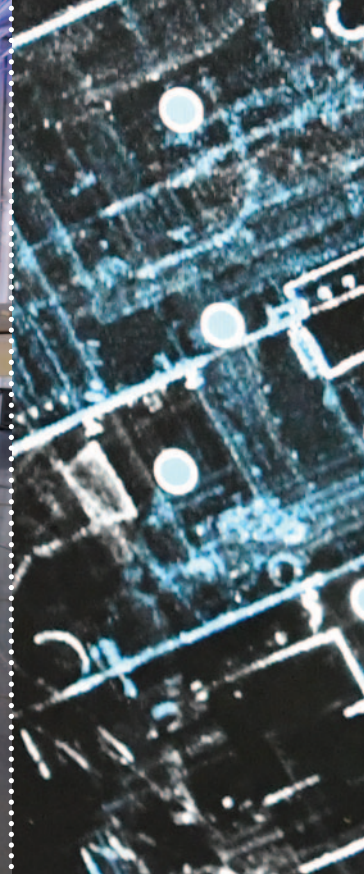
Intrepid

The promise of field-accurate site conditions, inside a three-dimensional (3D) building information modeling (BIM) project, is becoming a reality on construction sites and in early design discussions, thanks to better software import capabilities and newer, less-expensive, field-scanning technologies. Among those technologies is the FARO® Focus^s Laser Scanner.

On January 14-16, 2020, a 3D laser scanning training course was held at the Plumbers Local 1, New York, NY, Training Center. Patrick Ramirez, a Virtual Design Construction (VDC) Coordinator for the Arizona Pipe Trades Apprenticeship and a member of Plumbers and Pipefitters Local 469, Phoenix, AZ, was the instructor for this course. This course has been offered at the Instructor Training Program (ITP) for four years. Six students were in attendance for this session.



Michael Apuzzo (BM, LU 1), Jorge Sotomayor (Ap, LU 1), Arthur Klock Jr. (Director of Education, LU 1), and Daniel Fortini (I, LU 1)



The FARO Focus[®] Laser Scanner is a high-speed 3D laser scanner for detailed measurement and documentation. The Focus[®] uses laser technology to produce exceedingly detailed 3D images of complex environments and geometries in only a few minutes. The resulting images are an assembly of millions of 3D measurement points. The Focus[®] works by sending an infrared laser beam into the center of its rotating mirror. The mirror deflects the laser beam on a vertical rotation around the environment being scanned. Scattered light from surrounding objects is then reflected back into the scanner. The scanner covers a 360 degree by 300 degree field of view. The single point measurements are repeated up to 976,000 times per second, which results in a point cloud—a 3D dataset of the scanner's environment.

For this course, the FARO scanner and the latest version of the FARO SCENE software were used, along with Autodesk[®] Navisworks and Autodesk[®] ReCap Pro software. The students were using the latest FARO scanner, the Focus[®] 350, which has long-range measurements up to 350 meters.

The purpose of this training course was for the students to learn how to create highly accurate 3D point clouds of existing structures and various mechanical systems for use with BIM applications, so they can use it in their own local training centers.

On the first day of the course, Brother Ramirez gave an introduction to FARO laser scanners and familiarized the students with the equipment and the related software. He demonstrated how to properly set up the laser scanner and then had the students practice setting it up. He then demonstrated how to conduct multiple 3D scans in order to accurately gather the necessary views of an existing structure.

In the afternoon, the *UA Journal* staff, the instructors, and the students headed over to the USS Intrepid, one of 24 Essex-class aircraft carriers built during World War II for the United States Navy, to practice using the FARO scanners. The USS Intrepid is berthed on the Hudson River and is the centerpiece of the Intrepid Sea, Air and Space Museum. The USS Intrepid employees opened parts of the ship that haven't been opened in many years to allow FARO and the UA to scan those areas and collect its data. Being in the limited spaces of the ship allowed the students to see the scanner's ability to collect the data of every nook and cranny.

FARO has a grant with the USS Intrepid to digitize the ship, and Keith Alcorn, who is a Senior Sales Engineer with FARO, serves as the Project Manager. He said, "They want to create a digital duplicate of the ship for historical preservation purposes, for maintenance and upkeep, for virtual fly-throughs, for presentation purposes, and for future renovations. They want

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David Verna (J, LU 322) and Pat Ramirez (VDC Coordinator, LU 469)



Ken Schneider (ITF Training Specialist)

to open more of the ship up. Twenty percent of the ship is a museum, and 30 percent is renovated office spaces, storage, etc. and not open to the public, and then 50 percent is untouched.”

In explaining what the goal is for scanning the USS Intrepid, Keith Alcorn said, “The untouched parts are the most fascinating to me. They can’t open up the whole ship, because that would cost a fortune, but they constantly want to change their exhibits around and offer more to the public, so producing a laser scan gives them accurate dimensions and a good idea of what they have and what their assets are so they can plan accordingly.”

The USS Intrepid is governed by the U.S. Navy, and the museum portion of the ship is privately funded, so obtaining a grant to scan the ship was a difficult task for FARO. Keith Alcorn said FARO has been working on scanning the ship for eight months. Keith reached out to Ken Schneider, who is a Training Specialist for the International Training Fund (ITF), to recruit people from the Veterans in Piping (VIP) program to help scan the USS Intrepid.

Ken Schneider said, “FARO reached out to us about helping out with scanning the Intrepid, and to be able to use this as a training tool as well as an example of a real-world situation

where we are going into some tight areas and some restricted spaces is really a perfect scenario for this training.”

Keith Alcorn added, “Some of these guys have never even been on the USS Intrepid, and they live here. So, involving them in the local museums while learning an application technology is awesome.”

Brother Schneider was present during the laser scanning course to oversee the training and help promote the agreement that the UA has in place with FARO. He said, “My role as a liaison between FARO and the UA is to help promote the agreement that we have in place, and to make sure that we get this equipment in more of our UA members’ hands, so that they can be the ones on the jobsites doing the work.” He continued, “It’s super important that we make sure we’re using our members to do the design, because we know what’s constructible, and the biggest issue you hear about drawings is that they’re not always constructible.”

The second day of the training course was spent on the USS Intrepid. The students and the instructors continued scanning different areas of the ship to expose them to the “what ifs” in the process of learning how to scan.

Brother Ramirez said, “The fundamental

Abbreviation Key:

- BM Business Manager
- I Instructor
- J Journeyman
- Ap Apprentice



Keith Alcorn (Senior Sales Engineer, FARO) and Jorge Sotomayor (Ap, LU 1)



“The motive that we have here at FARO is that our relationship is geared solely around education and trying to make sure we promote technology in the trades and see how far we can reach. So, we have supplied the UA with several pieces of equipment. We’ve trained a couple of the UA members to be certified FARO instructors so that they can deploy that information downstream.”

— Keith Alcorn, FARO

training on how to use the equipment in its general sense is not going to expose them to every type of environment they may scan in, and it’s not going to expose them to the critical, ‘What did I miss in that scan?’ until they actually experience that. So, what we’re doing on the Intrepid is exposing them to the ‘what ifs.’ What if they get into an area where they can’t scan in color because there’s not enough light?” He continued, “They need something in their minds to be able to call back on, and an environment like the Intrepid, where they’re exposed to high light, low light, and nice pristine conditions such as the hanger deck, creates an environment to look back on. They’re exposed to situations where they might need some of the data, but they don’t need everything modeled. Experiencing different environments creates familiarity, and they can draw on that when it comes time to make decisions later.”

Keith Alcorn is the point of contact between FARO and the UA. He said, “The motive that we have here at FARO is that our relationship is geared solely around education and trying to make sure we promote technology in the trades and see how far we can reach. So, we have supplied the UA with several pieces of equipment. We’ve trained a couple of the UA members to be certified FARO instructors so that they can deploy that information downstream.”

Brother Ramirez said, “The agreement between the UA and FARO establishes that they can be primary instructors at their home locals.

If they’re teaching part-time, and they’re also working for a contractor, now that contractor has a buy-in, because they have someone who’s certified in the equipment and the material. It’s a two-for-one for people who are still working in the field, but for full-time instructors, it gives the local a real value added.”

The morning of the third day of the 3D laser scanning course was spent back on the USS Intrepid so that the students could learn how to teach the members in their home locals how to utilize the FARO scanner. Brother Ramirez said that he has the students practice teaching him how to use the scanner so they can become familiar with how to instruct others. He said, “They’re going to have to be familiar with how to translate the jargon into layman’s terms. What does the jargon mean? What does the jargon entail? And then they have to remember how the screen looked on the device that they are programming to do what they’re instructing. It’s not just about doing the scanning so that we can give FARO some transmittable data; it’s teaching the student instructors what to take back and teach to their locals.”

In the afternoon on the third day, the students got tested on their basic understanding of the functions, the tool, and the software. In the software portion of the training course, the students used FARO SCENE and Autodesk ReCap to practice the steps involved with importing a scan file and converting it to a usable point cloud. Brother Ramirez explained that



Top row from left are Allan Wishnoff (I, LU 1), Daniel Fortini (I, LU 1), Keith Alcorn (Senior Sales Engineer, FARO), Arthur Klock Jr. (Director of Education, LU 1), and Ken Schneider (ITF Training Specialist, UA).

Bottom row from left are Steve Cuadra (Director of Education, LU 638), Daniel Knights (I, LU 638), Pat Ramirez (VDC Coordinator, LU 469), Jorge Sotomayor (Ap, LU 1), Stephen Powers (I, LU 638), David Verna (J, LU 322), Matthew Marchese (Ap, LU 638), and Paul Garcia (J, LU 393).



going through this training course permits the students to request a FARO scanner from the UA, which gives them the ability to practice with it in order to teach a course. Part of the certified agreement with FARO is that those who go through one of the UA's 3D laser scanning training courses will get a trained certified instructor rate for their locals.

Brother Schneider said, "One of the ways I think that locals could really benefit from this training is they could laser scan their training centers. They could recreate their training center and make a digital duplicate, which would allow them to virtually make all kinds of changes to their training centers before they physically make those changes."

The incorporation of laser scanning into construction projects is vital and can even be considered urgent in today's marketplace. Brother Ramirez said, "Laser scanning is used almost every day in construction applications for building information modeling." The annual growth rate for 3D laser scanning is around 15 percent. Valued at \$3 billion in 2016, it's a market that is expected to grow to \$10 billion by 2024.

Laser scanning is a primary solution for budget optimization. It's a desirable solution that makes planning and pre-construction easier and faster. Keith Alcorn said, "With FARO, you can double check percent complete on new projects. For older projects, renovations, and adaptive reuse, it can be used to collect the existing systems. Blueprints aren't always accurate, especially if they're

older, so it's a way to collect exactly what you have. It's also a way to collect the inaccuracies of a building so you can design around those. It's always good to collect, and it's a very inexpensive way to collect a large amount of data."

There are many benefits of the FARO Focus[®] Laser Scanners, one of them being that users are able to preview scans of their projects while still in the field and confirm that all of their project requirements have been accounted for to make any necessary adjustments in real time.

Keith Alcorn said, "I see the application being in brand-new construction. If you're prefabbing your systems and you want to measure before you do that last prefabrication, now you can prefabricate more accurately."

Laser scanning is quickly becoming more prevalent on jobsites because of its many benefits. It improves quality and accuracy, saves money, provides immediate information to streamline productivity, can reduce manual labor, and improves coordination and collaboration on a jobsite.

Keith Alcorn said, "I love the enthusiasm for the technology. The UA members and instructors are thirsty for knowledge, and they're constantly seeking new and faster ways to get from point A to point B. Pat Ramirez, Mike Zivanovic, and Erik Lambrecht have all been innovators when it comes to streamlining the process, and they've done a great job taking the technology and training on how to use the FARO scanner to as many people as they can."

