Theatre Reimagined

A Renovation Study in Five Acts

The $32 million transformation of Atlanta's Alliance Theatre is a masterclass in design and prefabrication collaboration

The renovation of Atlanta's Alliance Theater utilized trailblazing technology to pair hand-crafted woodworking with cutting edge design and prefabrication. Photo by Greg Mooney.

Prologue

The Woodruff Arts Center is the cultural heart of Atlanta, Ga. The storied Midtown campus opened its doors in 1968 and serves as the home of the Grammy Award-winning Atlanta Symphony Orchestra, the High Museum of Art, and the Tony Award-winning Alliance Theatre.

This project study focuses on the recent renovation of The Woodruff's theatre venue, the **Alliance Theatre**.

The Alliance Theatre is a producing theatre that stages large amplified musicals as well as spoken-word theatre that is reliant on natural acoustics to carry the actors' voices to a seating capacity of 650. To maintain the venue's national reputation, the Woodruff's senior leadership authorized a comprehensive top-to-bottom renovation of the theatre in 2015. The aim of the reinvention, the first since the theatre's opening in 1968, is threefold:

- Improve the patron experience through an assortment of design enhancements and innovations
- Update audio, lighting, and computer-assisted technology
- Upgrade infrastructure such as the addition of catwalks and renovations of storage, classroom, and rehearsal space

Woodruff officials conducted a national design competition to determine the architect for the $32 million project. New Orleans-based Trahan Architects was selected from a field of 30 candidates. Founder and principal of Trahan Architects, Trey Trahan, FAIA, says of his team's

"The Alliance Theatre will lead the national field by deeply engaging with its local community, modeling radical inclusion and catalytic experiences ..."

–from the Alliance Theatre Vision Statement

winning concept, "The theatre will truly be a one-of-a-kind place for creating community in the performance space."

Act 1: Audacious Vision

What Trahan envisioned for the "one-of-a-kind" distinction is audacious in scope and ambition. The bold concept marries two disparate forms—hand-crafted woodworking with cutting edge design and prefabrication – to create a showcase of nature and technology that reinvents the theatre-going experience.

Trahan worked alongside practice colleagues Leigh Breslau, AIA, a leading expert in public and cultural space design, Brad Mcwhirter, AIA, technical director, and Robbie Eleazer, AIA, project lead and design architect, as well as staff designers to "... create a space that met the acoustical needs in a beautiful, integrated, and seamless way."

"We're on an arts campus with very sophisticated, austere architecture," explains Eleazer. "We wanted to do something that is much more humanistic and inviting. It's really about provoking people to interact with architecture. Please look and please touch."

Breslau adds, "Intimacy and envelopment drove our design. We wanted to wrap the audience in our arms and pull them together." The owner also challenged the Trahan team to create an enduring work of beauty exemplified by the woodturning art created by the Moulthrop family, acclaimed American woodturners. "The trick was how to make this affordable. Our budget was less than half of what initial estimates projected," says Breslau.

The design solution pointed to wood, a material that gracefully ages, patinas, and adds a natural warmth to the space. But what form and shape should the design take? "I remembered the work of Matthias Pliessnig and his beautiful benches of reclaimed wood," recalls Trahan. "We could be ecologically responsible and work with forms that could be shaped and sculpted." Pliessnig is a Brooklyn, N.Y. artist that creates free-form furniture and sculpture composed of long strips of steam-shaped wood, a fabrication process used for hundreds of years in wood-hull shipbuilding.

Working directly with Pliessnig, the Trahan team devised a concept that embraced the artist's ideas on a grand scale: The integration of 100,000 linear feet (nearly 19 miles) of expertly-milled white oak threads in the theatre chamber's design form. Each square-shaped thread measures ½-inch on a side and can run as long as 10 feet. The straight-running thread is then steam-bent in precise, unique double-curved patterns. Threads are then arrayed in a latticework to form curvy, sinewy panels (see photos). The panels are assembled to form seamless patterns that envelope the audience in a flowing, vineyard-style theatre aesthetic. Straight lines? Right angles? You won't find many in the new Alliance Theatre.

To help sell the idea to ownership, Pliessnig was commissioned by the architect to create a single panel of shaped threads. The panel was presented to the board in a dramatic 1:1 scale, demonstrating what the reimagined theatre could not only look like, but *feel* like. The reaction from The Woodruff board was immediate, according to Eleazer "They quickly saw the vision in a way that a paper drawing and discussion could never achieve," the architect says. The Trahan design team had their green light.

Act 2: Success Through Iteration

Just one hitch. The swooping, swirling wood-threaded panels now had to be created and installed at scale. There were no templates to follow. The magnitude dwarfed anything Pliessnig had previously accomplished on his own. When Pliessnig decided to continue to focus on his art, who could Trahan find to engineer, prefabricate, transport, and install Pliessnig-like quality at scale?

Eleazer says a call went out to three millwork fabricators. Within a very short time, one clear-cut favorite emerged: A family-owned and operated design assist and fabrication company out of Plaistow, N.H., CW Keller and Associates.

"They never used the word 'complicated' in speaking with us, which was a good sign," McWhirter recalls, in describing CW Keller. "They speak our language from a design process. They weren't scared by the complex geometry." Keller is a vertically integrated architectural specialties fabricator, maintaining nearly all fabrication processes in-house, from sophisticated design modeling to old-school wood-steaming and forming. "Keller works in a fundamentally different way than other fabricators," McWhirter observes.

One reason officials at CW Keller and Associates (CWKA) felt confident was their growing mastery of complex construction projects. The New Hampshire fabricator counted on an assortment of in-house advantages in tackling the assignment, including:

- Major investments in computer numeric control (CNC) milling processes
- A team of skilled woodworking and engineering professionals with a 40-year history of applying innovative solutions to challenging customer assignments
- Trusted alliances with leading manufacturing technology names, which was to prove indispensable in the design and assembly work that was to follow

CWKA president Shawn Keller remembers the early talks with Trahan well. "We don't try to solve every problem before we start a project," Keller says. "Two years ago when we started the Alliance Theatre job, we weren't 100 percent certain how we were going to finish the project. It's too complex to understand every nuance immediately with such detailed geometric forms. From an engineering standpoint, we continuously iterate and trust in the process."

Working from construction drawings of the reimagined theatre chamber created by the Trahan team, CWKA engineering and production teams set out to understand the workflow, materials, and fabrication process required. Among the early hurdles: How much would it cost? What tools do you use? How do you safely transport the prefabricated parts and pieces from a New Hampshire workshop to Midtown Atlanta, a distance of 1,110 miles? How do you accurately prefabricate so it perfectly synchs with the work of the steel fabricators and concrete contractors?

As Keller flatly puts it, "We can't modify anything on site." What leaves the Plaistow workshop must meet a 1/32-inch tolerance at a worksite more than a 1,000 miles away.

The construction plans called for more than 200 customized panels representing nine design types, each type formulated to meet strict acoustic requirements. The new Alliance Theatre must sound as good as it looks. A single panel can weigh up to 3,000 pounds.

Act 3: Let Laser Light the Way

Key to next steps at CWKA was a reliable understanding of the existing theatre's precise dimensions. Fortunately, the CWKA design and engineering had a head start in that process. Around 2010 they purchased a Focus Laser Scanner from FARO® Technologies. "The ability to go to a job site, laser scan it, and bring that data back to the shop is something we built into our workflow very quickly," Keller explains. "Documenting existing conditions with a high degree of resolution and tolerance allows us to better manage project risk."

Keller says it wasn't difficult to ascribe an ROI to laser scanning processes. "We ran some quick numbers. If the laser scanner saves us five field survey trips or change requests in the first 18 months, it's paid for itself," he says. Keller estimates that goal was met by a "... 10-fold factor at the end of the day."

Keller's Lead Engineer on the project, Matt Arsenault, agrees, "Our craftsmen no longer second-guess themselves. They're more effective because they're more confident. It's integral to our workflow now."

The team at Trahan designed the 200-plus theatre panels using an assortment of software. The principle applications were Rhinoceros 3D® (Rhino), Autodesk® Maya®, Grasshopper®, and Autodesk® Revit®.

"We don't have a single platform that gives us everything we need," explains Eleazer. "Every platform does some things great and other things not-so great." The architect's thumbnail description of each:

- **Rhino.** "A really great freeform and accurate modeler, but a bit rigid to work with."
- **Maya.** "Traditional animation software, but with polygon modeling. A really important tool for us, especially early in the project."
- **Grasshopper.** "A great way to automate detailed repetitive services, called scripts, that might be repeated dozens, even hundreds of times, within the Rhino application."
- **Revit.** "At the end of the day, we deliver full construction drawing sets into Revit. Revit synthesizes our processes across many platforms. We hit the ground running with Keller with them early because they were very familiar with our tools, especially Rhino. We spoke the same language."

Arsenault says software compatibility with Trahan was a project asset. "We do nearly all our modeling with Rhino and Grasshopper. We can adapt site conditions to our tolerances since all our modeling is computational," the CWKA project engineer says.

The software used for scanned point cloud data and registration was FARO SCENE.

Arsenault singles out another FARO software application, **FARO BuildIT Construction**, as a key project application. BuildIT wasn't introduced to CWKA until after panel prefabrication work was well along. However, BuildIT proved to be hugely instrumental in not only fabrication but also installation, thanks to the hardware it supports, the FARO Tracer^{SI} Laser Projector, or Tracer for short.

Act 5: Tracer to the Rescue

Scene 1: Input vs. Output

To understand the value of Tracer, it's important to contrast the differences between laser scanning and laser projection. Ben Parkin, a FARO applications engineer, says "A laser scanner collects a point cloud of data within the environment you're investigating, like the Alliance Theatre chamber. It's an *input* device, gathering information.

"The FARO Tracer, by contrast, is an output device, projecting data from a model Trahan may provide and literally projects that information, say the placement points for a theatre panel, on the actual theatre wall based on the earlier scan. It's a virtual templating solution," Parkin says.

CWKA used the FARO Tracer Laser Projector to assist with panel fabrication. The Tracer projected a template, shown here in green, to guide steam bending and thread placement.

"The Tracer is used with BuildIT Projector software. That software takes a design model and creates laser projection files. The original design files have a lot of information that isn't important to the projector itself, so the BuildIT software creates projection files that are used to specifically locate where items go," Parkin says. "For example, they might take a scan of this building, and then from that scan, they'll create a model and choose key features that need to be projected and then they'll be able to project those out to guide someone on how to locate the parts."

Architect Eleazer likens the functionality to a "spatial mold" that eliminates the waste of hundreds of registration rips, pallets, and plywood sections. "The technology allows us to work in a more responsible way with a level of digital honesty no one could argue with. I wish Keller could have actually taken on more coordination scope," Eleazer says.

For Arsenault and CWKA, Tracer advanced the project on two fronts.

Scene 2: Fabrication: A Prayer Answered

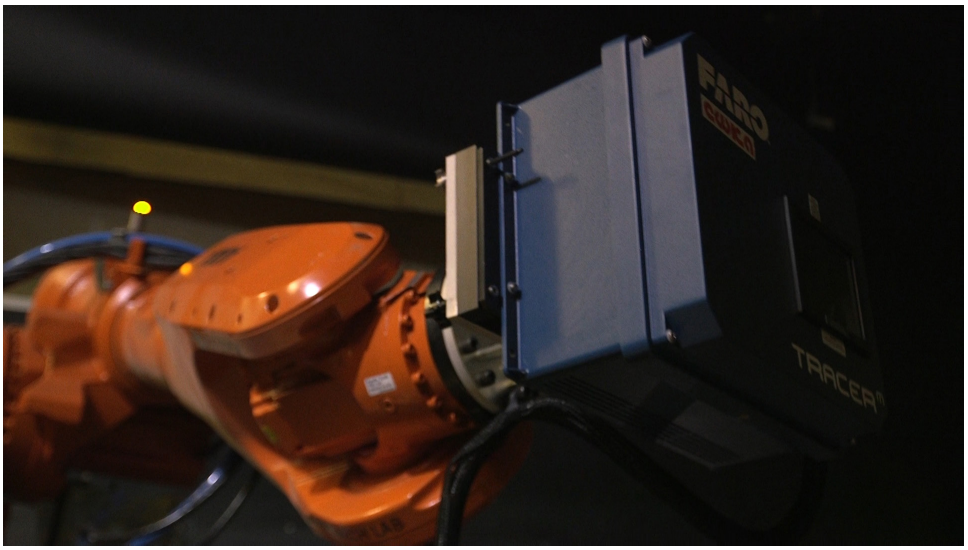
At the fabrication shop, the CWKA team has wrestled with how they were going to bend and place each white oak thread with the required level of precision. The default process was to create paper templates to guide steam bending and then thread placement on the panel array. Doable, but a laborious manual process subject to mistakes.

"We didn't know the Tracer existed at that point," Arsenault recalls. "We thought if we could take a laser pointer on a robotic arm we could use that to help our craftsmen to lay out the piece on the right spot.

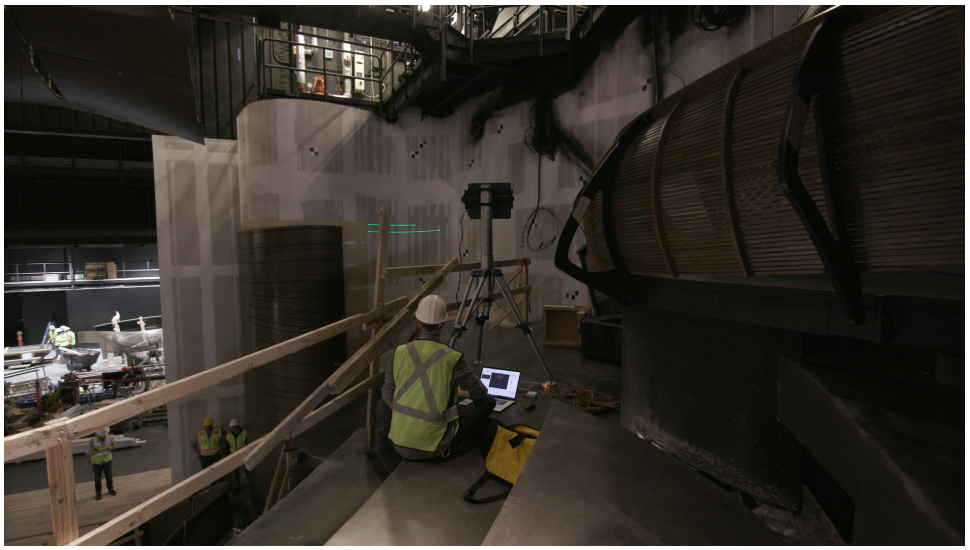
"Then we found out about the Tracer and that changed everything."

Scene 3: Installation: Leap of Faith

Virtually templating— projecting extremely accurate templates on a manufacturing surface—is the gold standard for fabrication precision in aerospace manufacturing. The idea of applying the same technology to construction is still in its infancy. "It's crazy for me to think this technology has been around for years," laments Arsenault. "The Tracer is vastly



CWKA design engineer Noni Pittenger, who was based at the Autodesk Technology Center, supported the efforts at the Alliance Theater through her research on robotics and the Tracer.



The CWKA team used the Tracer in combination with FARO BuildIT Construction software to project panel templates onto theatre walls.

quicker and more effective than laying out with a tape measure and checking it three or four times only to discover weeks later the manual tape measure reading was wrong."

CWKA immediately applied the Tracer to panel fabrication, precisely bending and setting each white oak thread with digital precision thanks to the projected green-illuminated template. They also quickly reasoned, if the Tracer works wonders for panel fabrication, why not panel installation back in Atlanta? It sure made sense, given the complex geometry.

Keller says applying laser projection to panel assembly "... was the only place we made a leap of faith."

Scene 4: West Coast Lifeline

However, that leap of faith had a safety net: the Autodesk Technology Center at Pier 9 in San Francisco. Working alongside Autodesk researchers at the Pier 9 facility, was CWKA design engineer and Pier 9 Innovator in Residence Noni Pittenger. As templating issues surfaced in Plaistow or Atlanta, a call to Pittenger put in motion some of the industry's top minds in solving the question. "Complex, curved parts

The Tracer allowed CWKA fabricators to place each white oak thread with digital precision, creating swooping and swirling panels.

and assembly challenge traditional means and methods of verification. We needed to apply digital tools in the field to confirm digitally designed work," Pittenger says.

"When engineers from New Hampshire or Georgia call me and say, 'This is the challenge we're facing,' I have some dedicated resources that I can lean on to solve the problem. I can call them right back with a collaborative solution. It's been really, really productive," Pittenger adds. For Autodesk, as well as FARO, the insights gleaned from the Alliance Theatre project are helping inform new ways to innovate product for construction customers.

Scene 5: Faith Rewarded

Meanwhile, Keller's leap of faith was quickly rewarded. The projection system proved to be an essential element to panel installation in the theatre chamber. The Trahan team were wowed by what CWKA could accomplish through laser projection.

"We were really impressed. There's no wasteful middle process. They could quickly take our oak strip model and map it with steam bending or pencil tick marks. It was really exciting to watch them adapt this technology on the fly," McWhirter says.

Arsenault says the effect of seeing templates projected on theatre walls was galvanizing to an audience beyond CWKA and Trahan. "Other trades ask us if we can do it for them," Arsenault grins. His boss understands what the trades see. "The electrician can see the outlet locations. The same for the lighting person or the drywall hanger. We can do all that with Tracer technology," Keller observes.

Outcome

The Architect

The excitement surrounding the reimagined theatre is high. McWhirter is especially pleased by how technology was able to guide and inform old-world craftsmanship. "A lot of people look at this project and might conclude it's all about form-making, digital tools, and whizzbang laser technology. It's more than that, of course. It's about the integration of an aesthetic with acoustics and staging technology to create a cohesive, holistic design that works in a seamless way."

Trey Trahan is excited by the broader implications of laser-based reality capture and projection technology. "We have so many more design tools we can now apply to other projects. It doesn't have to be performing arts. It could be an innovation center, a classroom, a spiritual space, or an outdoor pavilion. FARO technology allows us to do some very exciting things in a very ecological, responsible way that's also very cost effective."

On the matter of cost, Breslau adds, "Theatre design consultants tell us the room looks like it cost more than twice our actual budget. Technology made that possible."

The Engineer

Arsenault credits the one-two punch of laser scanning and projection for making the project possible. "We wouldn't be in the position we are now without FARO," he says. "We disrupted a process and FARO jumped at the chance to help. Every time we start a dialogue about projection, we realize even more uses for the technology. They've been fantastic."

The Fabricator

Keller detects his company, as well as the construction industry at large, may be at a tipping point. "We've learned a tremendous amount. It's a signature project. What's really exciting, though, is having dipped our toe into laser projection technology. We know it can be a part of our shop workflow. If we continue to collaborate with FARO and pull in Autodesk here and there, we know there's so much more that can be done.

"This is the tip of the iceberg in the construction environment."

For More Information

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