



by Robert Farrell, president, Farrell MarCom LLC

NESTING IN 3-D

By optimizing machine functionality for laser tube cutting operations, fabricators save time and money

If you thought processing flat material was complicated, try nesting and cutting 3-D tubes, pipes and beams. In the past, these tasks were relegated to only the most experienced staff members. Fortunately, however, veteran fabricators no longer have to take on the sole responsibility of each and every challenging tube cutting job that lands on a shop floor.

To learn more about the changing tides, *Shop Floor Lasers* sat down with Anthony Johnson, SigmaTek Systems LLC's regional sales representative. Johnson has several years under his belt in the fabrication and manufacturing industry and is well versed in the science (and art) of processing tubes.

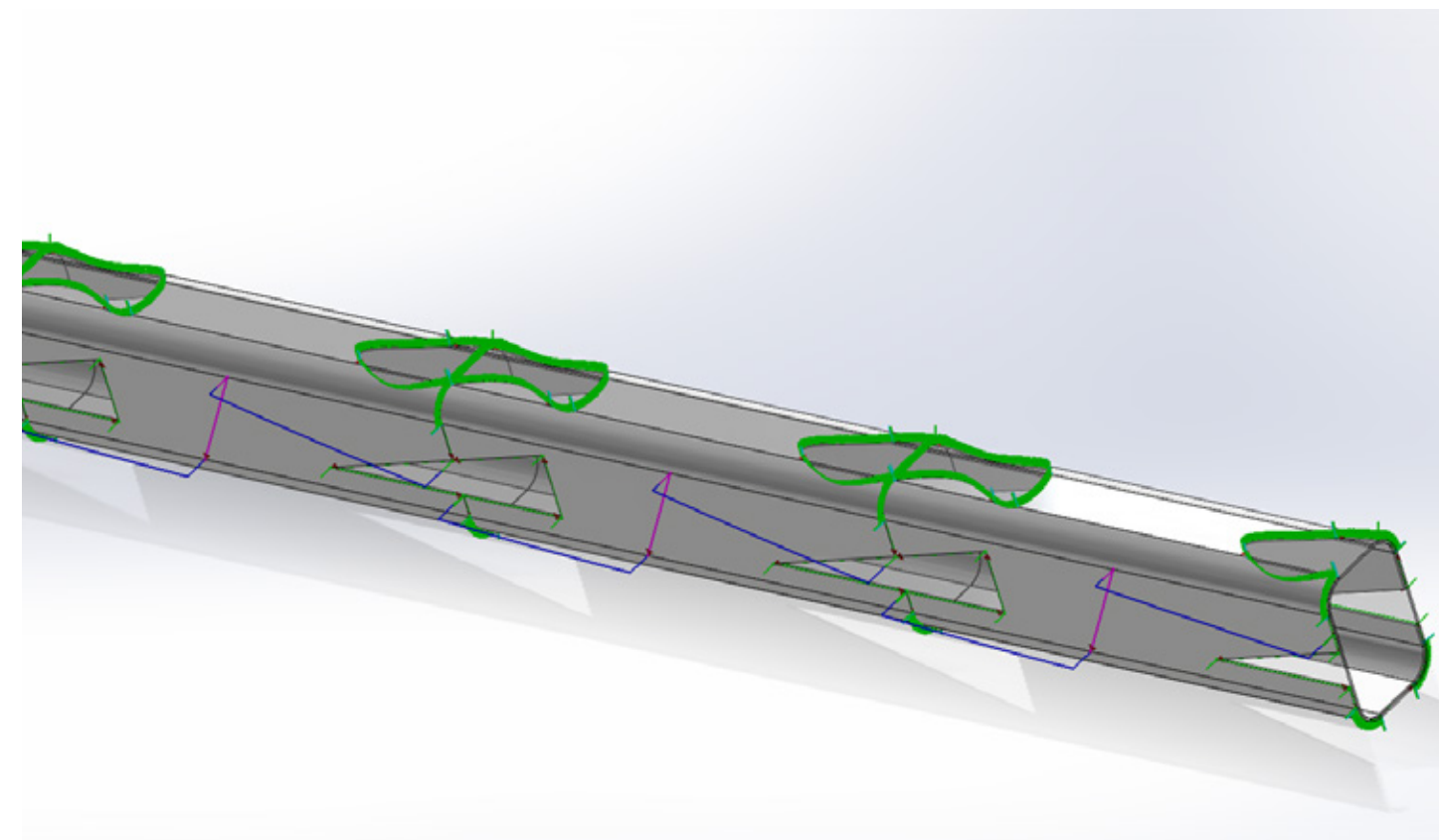
SFL: Starting on the ground floor, can you describe the process of tube cutting?

Johnson: When you hear the term tube cutting, you might think of a round metal tube or pipe. And yes, the most common materials are round 1 1/2-in.-thin wall pipe. But, in addition to pipes and tubes, tube cutting can

include beams in a variety of shapes, such as rectangular, square, C-channel, H-beams, I-beams, angle iron or any number of user-defined shapes. And it's not just cut-to-length work; holes, slots and a whole host of complex cutouts can be included in the process.

What are some of the overriding goals when it comes to tube cutting?

Johnson: I work with fabricators to help maximize their tube cutting investments by getting the most out of their machines. This often involves identifying and overcoming cutting obstacles, establishing best practices and looking for opportunities to automate manual processes. At the same time, I maintain close relationships with several machine OEMs. This is valuable as it allows me to keep abreast of equipment updates and other bits of information that I can pass along to fabricators. It also allows me to provide feedback to machine manufacturers to help them understand how to best put tube cutting capabilities into the hands of smaller fabricators that may not have deep pockets for high-end machines.



The TrueShape nesting feature by SigmaTube is capable of matching geometries for common line cutting.

What are the main industries that cut and nest structurals on a regular basis?

Johnson: When it comes to support beams, handrails and decorative components, the building construction industry is an obvious example. But, tube processing is also important to vehicle, aerospace and trailer manufacturers, among others. When you think about it, there are very few industries that don't utilize tube cutting to some degree.

What types of machines represent the best options for processing tubes?

Johnson: Laser and plasma are the primary players. Some robotic machines employ a fixed laser or plasma head cutting. And, of course, there are still saws and drills out there among the various shop floors. Any fabricator serving or wanting to process jobs for industries requiring structural components should invest in a tube cutting machine. Miter saws, drills →

and smaller bandsaws may be fine for a backyard project, but most do not suffice in today's manufacturing environment.

All that said, lasers offer a number of advantages. Just as with plate or sheet metal, lasers produce superior edge quality and achieve better fit-up on tubes and, therefore, easier welding. Smaller kerf and the ability to utilize common line cutting has a measurable impact on cutting speed and more complete material utilization.

What are some of the challenges associated with laser tube cutting?

Johnson: There are several challenges, especially with novice machine operators that may have come up through the ranks cutting on saws. Effective tube cutting requires complex calculations and precision. Hand measurements are largely inaccurate and result in excessive finishing work and too many scrapped parts. Regardless of experience, I'd say that the biggest obstacle operators face is the

ability to make cutting adjustments to compensate for a machine's limitations.

For example, a 90-degree cut requires two 45-degree cuts. Performing this manually is difficult – even for experienced operators. Other challenges include custom 3-D toolpath generation, the ability to compensate for welding, feature recognition and adjustments to the model for welding needs.

Can you give examples of the adjustments that are sometimes required for the laser machine and model?

Johnson: Not all tube laser cutting machines are equipped with a head for beveling despite the fact that an angle cut is important for fitting tubes together more precisely to allow for better welding. However, it's still possible to make adjustments to the machine and model to perform bevel cutting. SigmaTube software, as an example, makes adjustments to the model to cut based on the inner edge, known as fourth-axis geometry compensation. This allows machines that do not have →

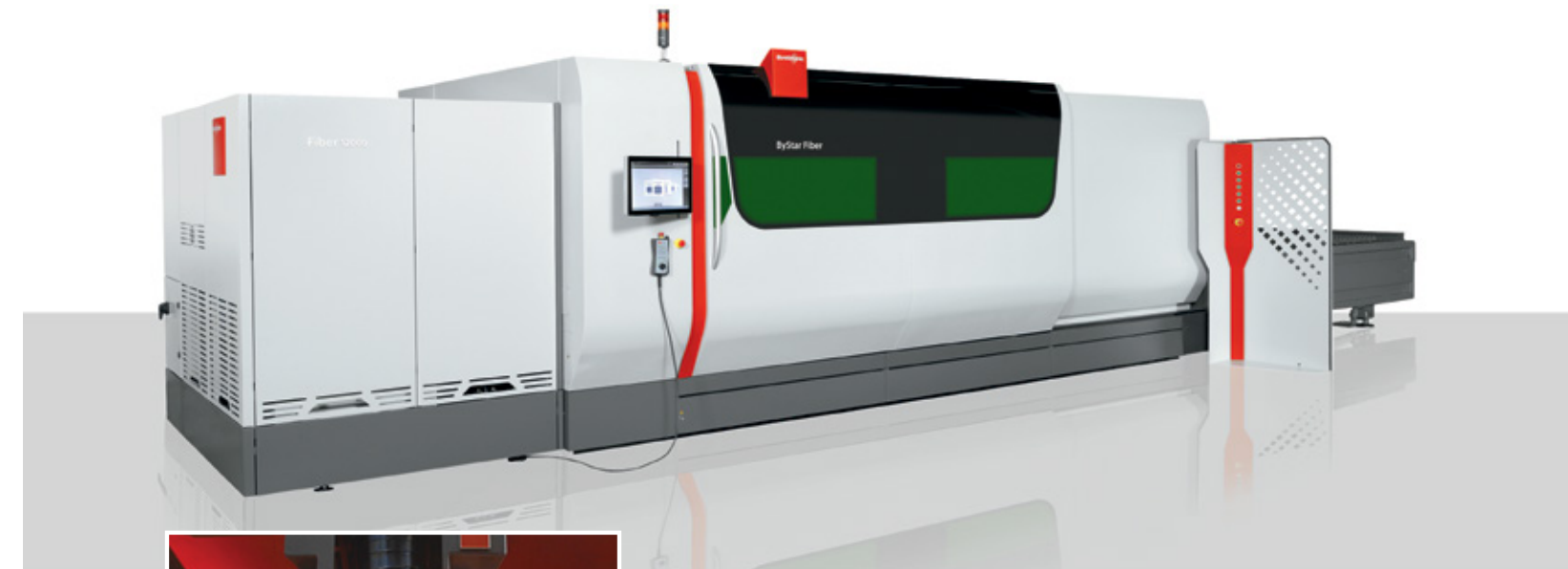
Best choice.

Introducing ByStar Fiber 12kW

High Performance Innovation Redefined.

- Unprecedented cutting speeds with 12kW of Fiber laser power
- Bystronic cutting head for exceptional cut quality up to 1.125 inch
- Innovative "BeamShaper" function for thick steel plate cutting applications
- Job shop flexibility with rotary axis tube processing option
- High performance automation solutions including part sorting

ByStar Fiber... in a high performance class of its own.

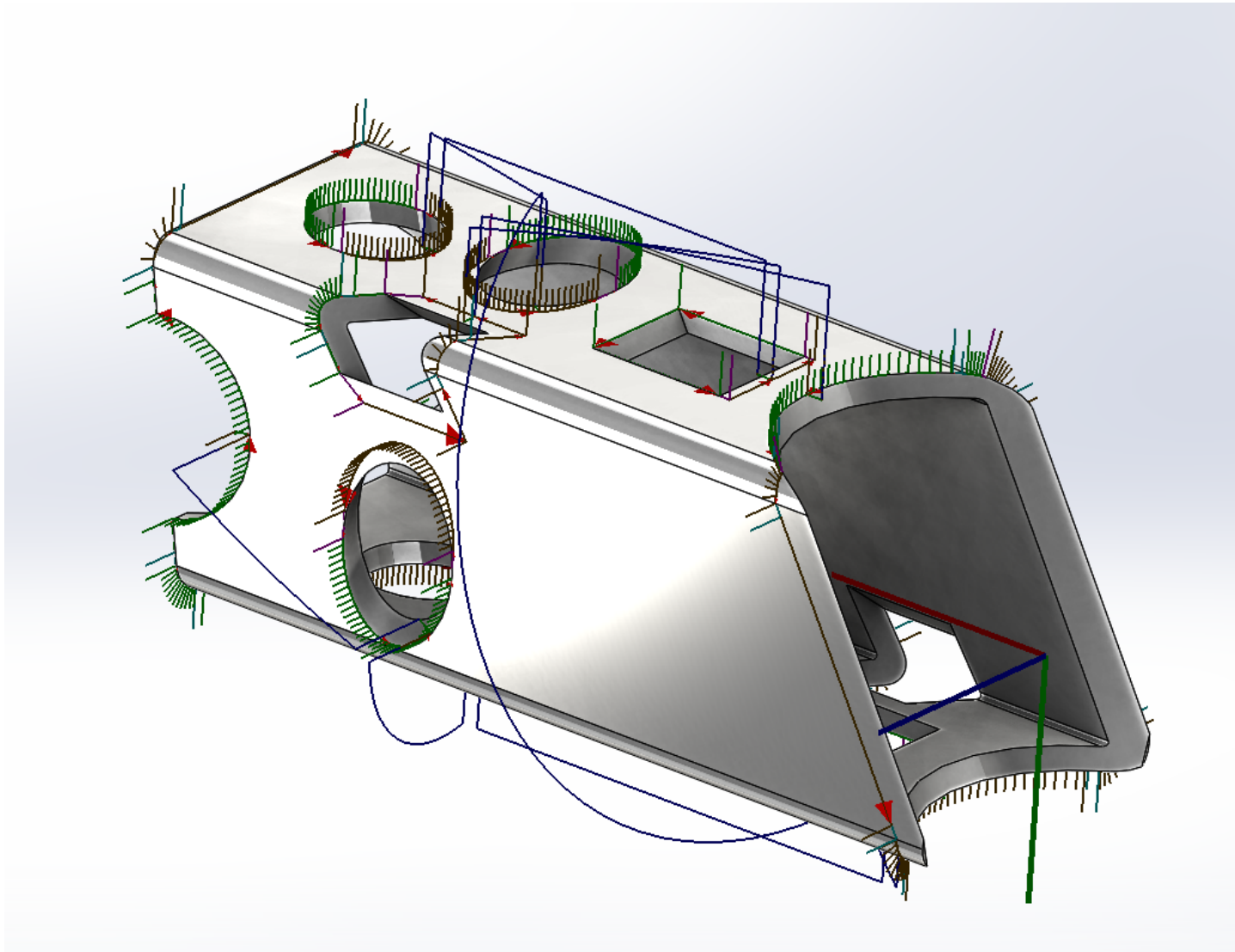


Experience the Bystronic difference with world-class Fiber laser cutting and our exceptional customer support.

Call today to schedule a time study and to visit our showroom.

Bystronic: Best choice.

Cutting | Bending | Automation
800-247-3332 | bystronicusa.com



Geometry compensation for creating weld-ready parts on non-beveling laser cutting machines.

a bevel head to cut bevel parts without the necessity of grinding away extra material for welding.

What is feature recognition?

Johnson: Feature recognition extracts features and their parameters from solid models. In addition to

recognizing holes, slots and other cut features, SigmaTube is able to recognize the tube profile and thickness in order to group like parts together for nesting. Feature recognition saves valuable time because it eliminates errors and a need to redraw parts.

How important is material yield in tube cutting?

Johnson: Yield absolutely matters and it largely boils down to accuracy. Accuracy is a problem with manual tube cutting and saws. Often, the last 8 in. to 12 in. of tube material is scrap. This doesn't sound like much, but material is costly and it can really add up. Just as with plate, it's important to squeeze every bit as possible out of the material.

How can nesting software help with scrap reduction in tube cutting?

Johnson: Scrap reduction is achieved in a few ways, but can start with SigmaTek's TrueShape nesting feature. This allows parts to be flipped and rotated to achieve tighter fits than simply nesting based on maximum length.

How important is the software in the overall process?

Johnson: Tube cutting is complex and software automates and simplifies the process. Most machines come preloaded with software. Often this is a light version of a given software system. While this may be suitable for some

jobs, serious tube cutting requires more sophisticated and robust software. It's also important to have an ability to directly import a solid CAD model and nest the parts with just a few clicks. Again, this is where feature recognition, model and machine adjustments come in to play.

What other benefits can fabricators expect when using SigmaTube?

Johnson: SigmaTube is a largely intuitive program that simplifies complex tube cutting and produces faster order turnaround. Many machine functions, such as tapping, repositioning and chucking, are automated. Bevel cuts are automatically processed, and common line cutting can be applied to many different profiles. I can tell you from experience that adding SigmaTube supercharges the machine. It's like dropping a Ferrari engine into a Ford.

Is it compatible with all laser cutting machines?

Johnson: SigmaTube is compatible with nearly all cutting machines. →

Custom programs are available to fully maximize the advanced features of Mazak FabriGear, Trumpf, Bystronic, Amada, and other 3-D tube and pipe cutting laser machines.

What about CAD software?

Johnson: SigmaTube is an add-in module to the SolidWorks design interface. As a result, experienced CAD programmers find it quick to learn and easy to use. From creating parts to generating NC code, every aspect of programming is completed within SolidWorks. This eliminates time-consuming exports and any need for secondary CAM software. For those not using SolidWorks, we offer SigmaTube SX, which is our 3-D platform.

How does SigmaTube address edge and cut quality?

Johnson: It addresses them in a number of ways, including the fact that software supports beveling. If a machine doesn't have beveling capabilities, the software addresses this with the aforementioned fourth-axis module. Likewise, the software makes cutting calculations based on

the inside diameter of a tube. This provides more exact measurements and allowance for welding. With feature recognition, quality can be assigned based on cut area or even what type of feature is being cut, such as changing the quality automatically when rotating around a corner.

From your experience, what should a fabricator consider when purchasing a tube cutting machine?

Johnson: First and foremost, fabricators should think about durability. Tube processing is hard on equipment, and machine components matter. Pay close attention to the construction of a machine before you purchase it. In addition, the machine must be able to process stock well. Often stock is bundled and fed into the machine for continuous cutting. How well a machine handles stock is important to consistent cut quality.

Do you have any final tips or best practices to offer?

Johnson: Importing CAD files is an important and sometimes overlooked →

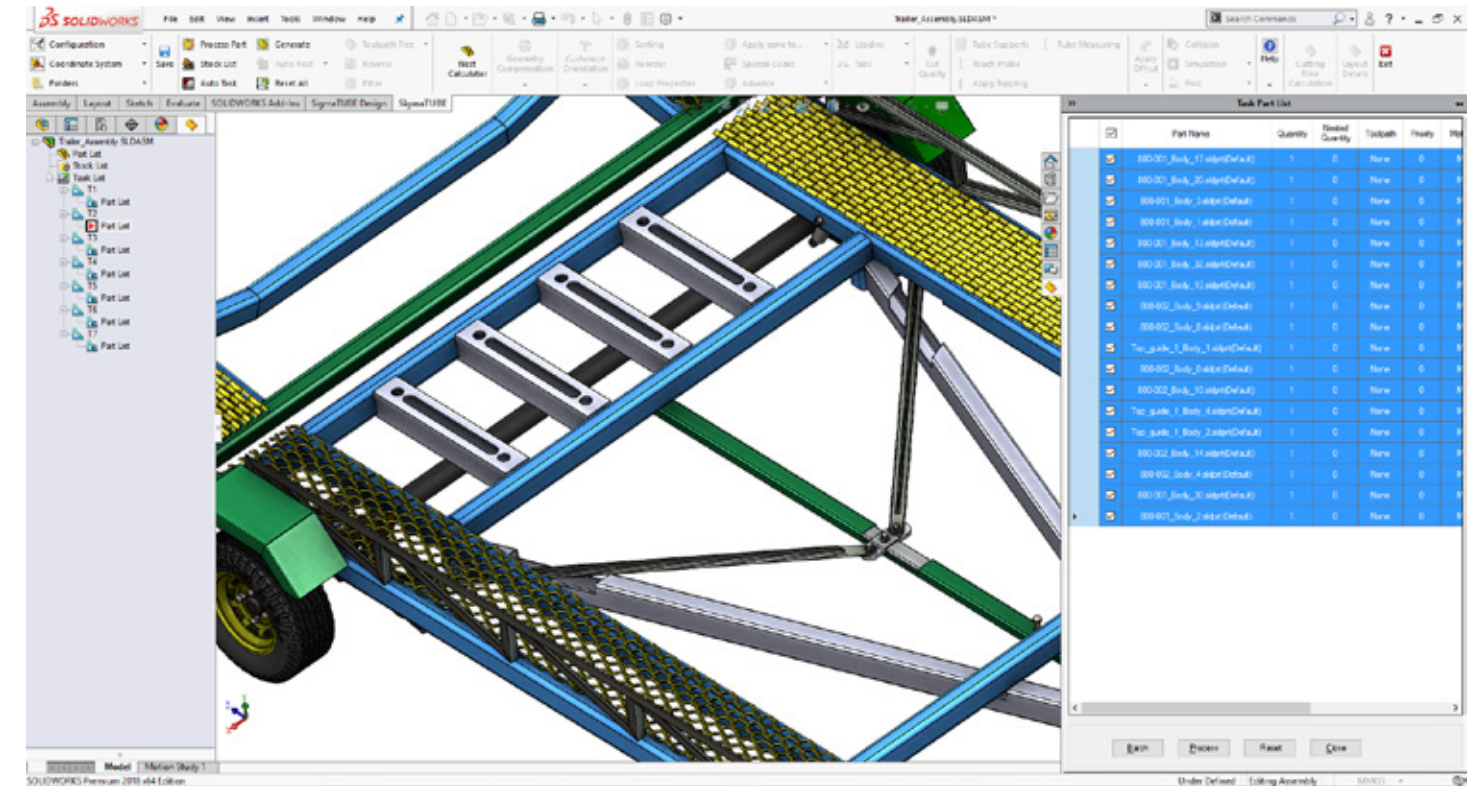
“Often, the last 8 in. to 12 in. of material is scrap. This doesn't sound like much, but material is costly and it can really add up.”

Anthony Johnson, regional sales representative, SigmaTek Systems LLC

To showcase the latest in digital advertising, Techgen Media offers a new portfolio of dynamic ad options. By leveraging advanced digital advertising, potential and existing customers are presented with new and exciting ways to engage with your brand.

To see the new ads in action, check out our interactive brochure.

[See the brochure](#)



↑ Automatic grouping of like parts within an assembly for nesting.

aspect of tube cutting. Aside from being a time-saver, it helps to ensure quality. Also, get to know your laser cutting machine and its features and take the time to run test parts and make sure that the machine is dialed in and set up correctly.

Naturally, you also want to make sure that your software system is fully maximizing your machine's features. A good example of this is the geometry compensation tool. If your machine can't bevel, you are not maximizing

its capabilities if you aren't using software capable of compensating the cut path to avoid requiring additional grinding for these bevel parts. The machine can produce a weld-ready part without beveling, so don't allow your software to limit the machine and require secondary processing that wastes time. You invested a lot in that machine; make sure you're getting everything out of it. ●

[SigmaTek Systems LLC](#) →