FF Journal

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FF Journal®

The magazine for today's metal fabricating & forming technologies

A TREND Publication

www.ffjournal.net

IRON WILL

150-year-old combat sub tells tale about its crew and the metalformers who built it

WELDING
Automation takes over the wheel

LASER TECHNOLOGY
Manufacturers migrate toward material handling

"The LCG 3015 AJ Fiber Laser and ASFH Automation allow us to operate 24/7. In today's competitive marketplace, AMADA has enabled us to be a more cost-effective option for our customers."

— Marty Tucker

Andy Tucker President/CEO (left) and Marty Tucker Vice President Metalcrafters, Inc.

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Andy Tucker, President/CEO and Marty Tucker, Vice President, attribute much of the company's success to partnering with AMADA for over 40 years. Marty Tucker put it in these words, *"Being a contract manufacturer/job shop we need to remain as flexible as possible. Our goal with purchasing the LCG 3015 AJ Fiber Laser and ASFH Automation was to process more parts per hour with equal or greater quality than previously seen on our CO_2 lasers... without hiring any additional personnel. We are extremely pleased with AMADA's solution. A 0.125" aluminum job that used to be machined is now laser cut. Machining process time was measured in minutes per part while laser-cutting takes less than 15 seconds and is burr-free."*

Andy Tucker adds, *"Leveraging the ASFH Automated Material Handling and Storage System enabled us to increase our capacity by more than 25% without adding any additional staff. Today, we have two employees running four laser cells."*

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September 2017

features

DEPARTMENTS

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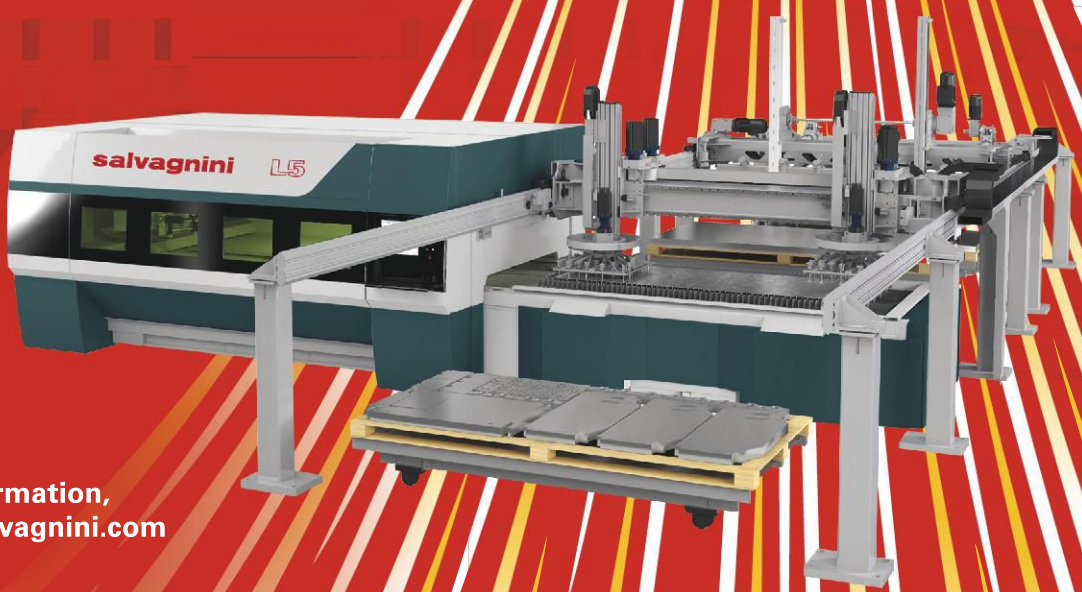

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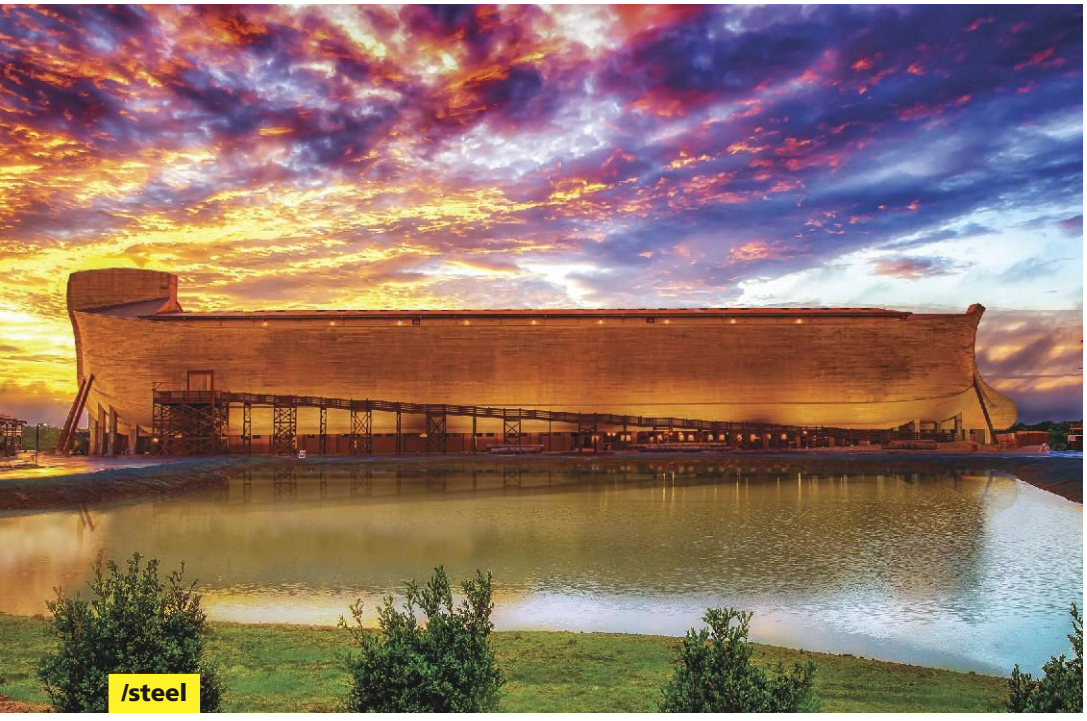

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Auto mechanics arm themselves with the tools needed to repair advanced aluminum bodies

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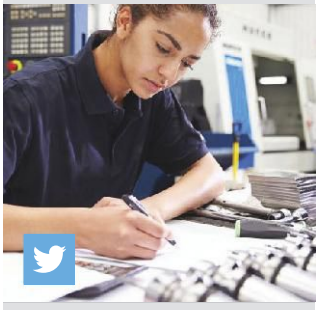

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Recruitment starts by encouraging gender diversity & providing equal footing for women.
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3D metal printing: Tips, trends, and common misconceptions. Photo: @MachineDesign

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From the Senior Editor

LYNN STANLEY

CIVIL WAR SUB

Technology has changed the way we live over the last century. In 1915, Alexander Graham Bell made the first coast-to-coast phone call. He predicted that, one day, calls "could be made without wires."

According to Pew Research Center, nearly 95 percent of Americans now own a cell phone. Bell told the 1917 graduating class of McKinley Manual Training School that "the man of science will be appreciated in the future as he never has been in the past."

I believe Bell was right. That's why we took a bit of a departure from reporting on the latest in forming and fabricating methods and applications to bring you a cover story about *H. L. Hunley*, the world's first combat submarine to sink a ship in 1864. We want to recognize those early ironworkers and the archaeology and conservation teams charged with rescuing *Hunley* and unraveling its mysteries.

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We also want to hail the team at the Warren Lasch Conservation Center at the Clemson University Restoration Institute in North Charleston, South Carolina, for a technique they developed to treat salt-impregnated archaeological iron.

In commercial applications, corrosion-resistant coatings and plating methods shield steel from salt and saltwater. For museums and facilities like WLCC, conventional methods for subtracting chloride from iron artifacts have included electrolysis and immersion in alkaline water-based solutions.

In 2002, Dr. Michael Drews, then a professor emeritus of Clemson's Department of Materials Science and Engineering, devised a way to treat *Hunley*'s iron artifacts with a process he had tested on textiles and other materials. In 2003, a major research effort launched a method to run subcritical experiments on archaeological iron at WLCC. The method had the potential to treat iron artifacts in a fraction of the time required by traditional methods.

Drews filed a U.S. patent on the treatment in 2006 and was awarded the intellectual property in 2011. In 2009, the WLCC designed and commissioned a subcritical reactor with a 1-ft.-wide by 2.5-ft.-long chamber suitable for big artifacts and batch treatment of smaller artifacts.

The process uses a diluted alkaline solution, heated to 350 degrees Fahrenheit and under high pressure, to extract embedded chloride ions out of metal.

The WLCC treatment "rapidly and efficiently removes chlorides, converting iron corrosion products into their most stable forms." A batch of test blocks took just seven days to treat.

Ian Macleod, former executive director for the collections management and conservation at the Western Australian Maritime Museum in Perth, Australia, has said, "I believe that this is the most significant advance in metals conservation in more than 80 years."

In the true spirit of invention, the WLCC team thinks the process can be scaled up to treat larger pieces including ship hulls. While economics will govern scale-up, the first step could be a unit big enough to treat a cannon.

Technology has changed the way we live but projects like the conservation of the *Hunley* show us that technology also links us to the past and to the future. **FFJ**

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Sticking to specs

Gary Cican, sales engineer for Laser Mechanisms Inc., explains how to troubleshoot a unit that's making poor-quality parts

Q. What are some typical issues companies can encounter with their laser processes?

Gary Cican: Laser processing has several variables. If just one of those parameters changes, your entire laser-cutting process may fall out of specification. One of the most common issues we see is contamination. The laser will not focus properly if its optics are contaminated. "Cleanliness is next to godliness" are words to live by with regard to laser beam delivery and optics. Also, it is extremely important that any gases or air used with the laser process are clean and dry to avoid or minimize contamination.

Another common problem is laser beam alignment. This is especially true during cutting. If the position of the beam is not properly centered in the nozzle orifice, dross and poor edge quality will occur.

Focus position and/or focus shift is another issue that can cause problems. The focus position, or focal point, is where the laser beam is at its smallest diameter. Laser cutting, welding, heat treating and cladding all require the focus position to be properly set relative to the workpiece. Sometimes the focus position is properly set but moves while processing. If the process looks good at the start but changes over time, a focus shift may be the issue. A damaged or contaminated optic is a common reason for focus shift.

Q. Once a problem is noticed, what steps should be taken to diagnose, evaluate and troubleshoot the issue?

Cican: Like most things in life, experience helps. This definitely applies when troubleshooting laser process issues. For new laser operators and maintenance personnel, I highly recommend some laser training to accelerate the learning curve. Laser applications and process training usually is available through the laser manufacturer, beam delivery supplier and third-party sources.

In many cases, laser process issues are related to a bad optic. Inspecting the optics may reveal damage or contamination. Cleaning or replacing the optic or optics can bring the laser process back online. If an optic is bad, it is important to take note of the failure mode, otherwise the issue could arise again. For example, if there is a haze continually noted on the bottom of a cover glass, the issue may be related to contamination of the laser-cutting assist gas. This problem will recur until the gas supply is clean and dry.

Several tools exist to help diagnose and evaluate laser processes. Power meters can be used to periodically measure laser power. Some companies integrate power meters directly into the workstation so measurements can be taken at the start of each shift. Other tools exist for checking beam alignment and focus position.

Q. Can companies create a routine maintenance and evaluation program for their shop environments to proactively address problems before they occur?

Cican: Scheduled preventive maintenance for inspecting CO_2 laser optics and checking beam alignment can definitely head off laser process problems down the road. Filtration systems used for gas or air should always be properly maintained at regular intervals.

For shorter wavelength fiber, disk and direct diode lasers, inspection of the optics in a manufacturing environment can create more contamination on the optics. For these systems, it can be best to check and replace cover slides as needed but use the beam delivery's internal sensors or external power, focus or process sensors to determine when an optics inspection is required.

Today, many laser processes have options for real-time process monitoring. When laser cutting, for example, detectors inside the head can be used to determine if a loss of cut accuracy has occurred. And when laser welding, there is a relatively new and exciting process monitoring technique called Inline Coherent Imaging (ICI), which measures the depth of penetration in real time. Although some of these systems are expensive, they can pay for themselves quickly by identifying a problem immediately and minimizing scrap parts and can virtually eliminate the cost of destructive inspection of completed parts.

Finally, one of the best things companies can do early on is applications work. Most laser manufacturers have application labs where you can send part samples to be laser processed. This not only helps determine laser power, speed and quality of the process but also determines feasibility. Ideally, the laser process should be robust as possible and have a large process window that can tolerate subtle changes in parameters. If the process window is too small, it will be very difficult to keep the laser process running well in production. **FFJ**

GARY CICAN, sales engineer, has been with Laser Mechanisms, Novi, Michigan, for more than 20 years. He works directly with leading laser machine tool builders in the industry and is on the front line of laser process feedback from end users.

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Decoding punch programming

Assess current methods to further automate processing

Although laser cutting's versatility has made it a prevalent technology for sheet metal fabricators, CNC punching continues to excel in applications where it can produce parts cheaper and faster and wherever secondary operations can be eliminated. Fabricators who rely on punching technology often struggle with programming operations because punch machines are inherently more involved to program than laser machines. This stems from myriad tooling options that introduce placement, ordering and tool path considerations.

Machine and tooling manufacturers continue to advance punching technology to broaden its applicability, and these advancements often increase the complexity of CNC punch programming. This leaves many fabricators questioning whether punch programming can ever move beyond interactive methods. The level of punch programming automation that can actually be achieved depends upon many factors, but at a minimum, existing programming processes can often be improved.

Tool placement

How automated CNC punch programming can become depends on how effectively the programming software applies tools to parts. This is the software operation that we most commonly think of as "punching." If the software punches every part optimally, then a high degree of automation is likely to be achieved.

But, as anyone who has ever programmed a punch machine knows, this can be quite challenging except with the simplest of parts. The following punching operations should be considered:

- **Standard tool placement—**Your programming software should be able to accurately place standard tools, such as rounds, obrounds, squares, rectangles, 'D' tools and polygons. But if your parts contain complex geometric configurations, such as involved bend reliefs, even the placement of standard tools can be challenging. Ideally your programming software will also memorize desired tooling patterns for a selected geometric configuration and repeat that tooling pattern as that geometric configuration is encountered in subsequent operations. This allows your punching software to adapt to your programming requirements and become more automated over time.

- **Shaker tab (micro-joint) placement—**Automatic placement of shaker tabs requires accurate calculation of tab locations and tab size, which can be both part and material dependent. Tabbing specific tools could require consideration.

- **Special tool placement—**Perhaps the most challenging punching operation to automate is the placement of special tools. Forming tools, tapping tools, rolling tools, cluster tools, bending tools, character tools, deburring tools and others can require extensive part analysis for accurate feature identification and tool placement.

In addition to automatic punching, programming software should quickly modify tooling on punched parts to override automatic tooling results and address engineering changes.

Pre-tooling vs. dynamic tooling

Punch programming software should provide the option to pre-tool parts, dynamically tool parts or some combination of the two. A pre-tooled part is one where the punch tooling is applied prior to the part being positioned on the sheet. The part is then maintained in a library with the tooling already in place. This is ideal for standard parts that are run repeatedly in varying quantities because it guarantees tooling accuracy and consistency.

Alternatively, parts can be dynamically tooled. This refers to parts being tooled on demand after, or in conjunction with, being placed on the sheet. A separate tooled instance of the part is not maintained. This is more suited to custom parts that are not likely to run again. Determining which approach to implement depends on such factors as production style, complexity of parts and punch machine features.

Extensive analysis

Accurately tooled parts are key to programming automation, but your programming software must also optimally process the tooled parts and take advantage of advanced punch machine capabilities. This can include tool sorting, tool path optimization, sheet repositioning, programmable clamp processing and drop door support. Each of these operations requires extensive analysis to automate, and each can introduce exceptions that must be managed.

Automating punch programming begins with an assessment of current programming methods. Each point of user intervention should be evaluated against programming software capability and process requirements. As software products continually advance, this should be an ongoing process with periodic reviews to ensure best practices. The end result may be significant reductions in punch programming time. FFJ

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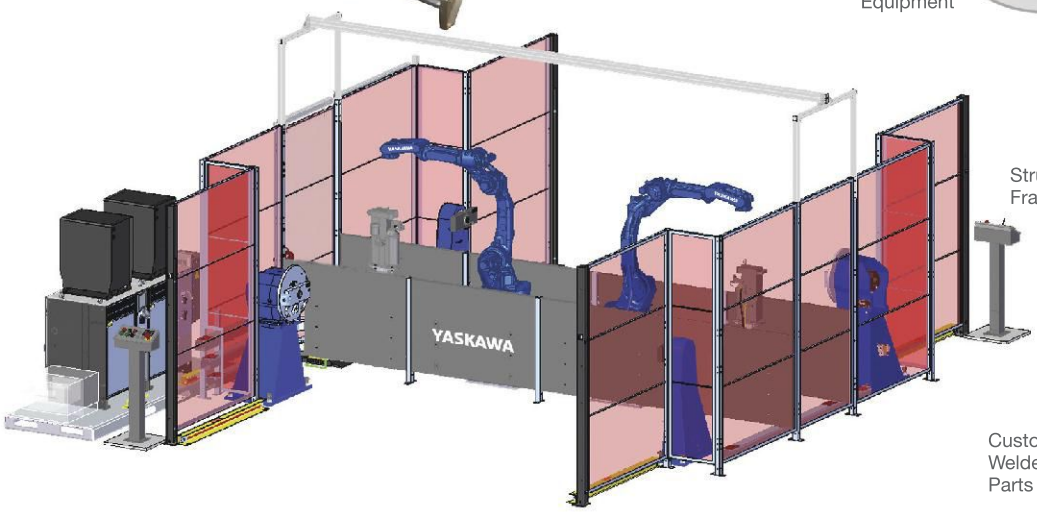

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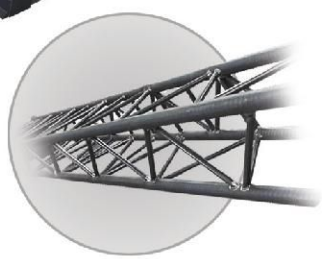

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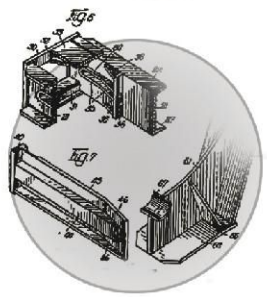

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Toolbox

Fiber laser updated with new drive system

The Optiflex 3015 Fiber III 8-kW laser-cutting system has been updated with a new PreviewG control and high-performance digital drive package to provide high speeds and increased accuracy. The PreviewG control operates similar to a smartphone or tablet. It is designed to integrate intelligent setup and monitoring functions to simplify operation and reduce operator dependency. The Optiflex 3015 Fiber III can be paired with Mazak's automated material handling systems and is equipped with sensors in the torch that monitor piercing and cutting operations to improve throughput and part quality.

Mazak Optonics Corp., Elgin, Illinois, 847/252-4500, www.mazakoptonics.com.

Torch increases welder comfort levels

American Weldquip's Cool-Grip semi-automatic MIG welding torch has been designed for cooler running operation in higher amperage welding applications. The torch's Cool-Grip has been engineered to increase welder comfort by providing relief in the handle when welding in higher heat applications. The design allows for cooler operation by inhibiting the transfer of heat that is generated at the welding arc and pulled back into the handle area by way of the gooseneck.

American Weldquip, Sharon Center, Ohio, 330/239-0317, www.weldquip.com.

Jib cranes articulate for multiple applications

Engineered Material Handling's 200-lb. and 500-lb. AL Systems aluminum rail jib cranes are lightweight and have spans up to 15 feet. The cranes are articulating, which means they do not require movement at right angles, and they have aluminum track profiles and are easily configured to suit myriad applications, including underneath bridge cranes, in areas serving multiple workstations, and outdoor loading docks.

Engineered Material Handling, Valley City, Ohio, 330/220-8600, www.emhcranes.com.

Large automated ironworker

Comeq Inc. has delivered a large automated ironworker—a GEKA Hydracrop 220 SD hydraulic model that features a semiautomatic gauging system and a punch tonnage of more than 240 tons. The Semi-Paxy automated punch has a table size of 16 inches in the Y direction and 40 inches in the X direction. Ball transfers, which allow easy movement of heavy parts, reduce setup and layout time and help eliminate errors that can occur with manual layout. The hydraulic punch stripper, which holds the material tight against the X and Y stops during the punching cycle, also helps to reduce the potential deformation of the part when punching. The capacity allows customers to punch heavy plates that would normally require drilling or burning.

Comeq Inc., White Marsh, Maryland, 410/933-8500 www.comeq.com.

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Toolbox

Alternative source for fixed-height tooling

AFH from Wilson Tool is a line of fixed-height tooling designed to be fully compatible with Amada fixed-height tooling and machine control. The tooling features beveled tang-style punches, is heat treated to 70 RCS using a proprietary Nitrex heat treat process to extend tool life and durability. Tip modifications, specials and custom configurations are available.

Wilson Tool International, White Bear Lake, Minnesota, 866/752-6531, www.wilsontool.com.

Line of handheld beveling tools

Saar-Hartmetall USA's line of handheld electric and pneumatic beveling tools can produce a variety of radius bevel edges including 2 mm, 3 mm, 4 mm, 6 mm and 8 mm. The line includes the SMA-E and SMA-P series of portable beveling tools.

Saar-Hartmetall USA, Covington, Kentucky, 859/331-8770, www.saarusa.com.

What's Happening

Emuge and Open Mind establish partnership

Emuge Corp., West Boylston, Massachusetts, a manufacturer of high-performance taps, drills, end mills and other rotary tools, has formed a partnership with **Open Mind Technologies AG**, Needham, Massachusetts, a developer of CAM/CAD software. The companies share technical data and best practices on machining applications and programs, participate in joint seminars, and collaborate to develop and promote advanced, high-productivity machining solutions.

21 years of Impax Tooling

Wilson Tool International celebrated its stamping division's 21st anniversary with an educational forum and party at its headquarters in White Bear Lake, Minnesota. Presentations by **Bohler Uddeholm** and **Special Springs** featured discussions on tool steels and spring selections, advancements in tooling and industry insights.

JK Tool opens Pennsylvania plant

JK Tool Inc., a designer and manufacturer of progressive stamping tools, precision machined components and custom assemblies, moved into a new, 18,000-sq.-ft. facility in New Kensington, Pennsylvania. The open floor plan and systematic design improves employee communication, process optimization and the ability to manage projects visually.

What's Happening

American Punch expands facility

American Punch Co., Euclid, Ohio, has begun construction on a major plant expansion that will nearly double the size of its production facility and increase its manufacturing capabilities. The work consists of a 23,000-sq.-ft. addition of plant space and 1,000 sq. ft. of office space. The company—maker of replacement and custom punches, dies and shear blades to fit all ironworkers (angle-line, beam-line and plate)—will install 800 solar panels on the roof of the new building that, over the next 25 years, will produce over 7 million kilowatts of electricity.

Merger creates new resistance welding company

Dengensha Mfg. Co. Ltd. merged with **Nastoa Welding Technologies Co. Ltd.**, creating Dengensha Toa Co. Ltd. "By focusing on the development of new products with the ability to join different types of materials together, Dengensha Toa aims to become a more comprehensive joining equipment manufacturer globally," a company spokesperson stated.

See more **NEWS** at www.ffjournal.net

HEH Group launches spindle repair company

HEH Group, Cuyahoga Falls, Ohio, launched a new business: **Advanced Spindle Technology** in Winston Salem, North Carolina. The company repairs machine tool spindles and stocks and sources components and bearings. If necessary, damaged components are refurbished or reverse engineered and produced in house.

Eye on People


Chris Morse


Melissa Clubine

Wila USA adds two to management team

Wila USA, Hanover, Maryland, named **Chris Morse** as senior vice president and **Melissa Clubine** as sales office manager. Morse has more than 20 years of experience in sales management. He will head up Wila's sales and business development efforts in the Americas. Clubine will oversee inside sales, applications engineering and warehouse teams.

Costa to succeed Gelinas at Rex-Cut


Bob Costa

Rex-Cut Abrasives, Fall River, Massachusetts, named **Bob Costa** as president, succeeding **Claude Gelinas**, who plans to retire in late 2018. Costa has a 37-year history with Rex-Cut Abrasives and has served as vice president of sales and marketing since 2008. Gelinas has been with the company over 40 years and was president since 1995. He will stay on as chairman of the board.

Roll-Kraft prepares for growth


Frank Mercuri

Roll-Kraft, Mentor, Ohio, a manufacturer of roll tooling, has added **Frank Mercuri** as CFO. Mercuri has 20 years' experience in accounting and finance, including CFO and controller for Ericson Manufacturing, Vocon Design and Brulant Inc. **Richard Lazar**, the former CFO, has moved into the position of director of finance–special projects, becoming involved in the company's future growth initiatives, commercial and process improvements. He has been with Roll-Kraft for 35 years.

Mazak Optonics promotes Mercurio

Mazak Optonics Corp., Elgin, Illinois, promoted **Mark Mercurio** from applications manager to the Midwest Central regional sales manager. He is a 20-year veteran of the company.

Mazak Corp. promotes Papke


Christopher Papke

Mazak Corp., Florence, Kentucky, promoted **Christopher Papke** to Southwest regional general manager. Papke succeeds **Dana Scott**, who is retiring after 19 years as the head of Mazak's Southwest Technology Center in Houston. Papke has worked for the company for 18 years.

BY LYNN STANLEY, SENIOR EDITOR

Meet the iron submarine that changed the course of naval warfare

Market pressures are squeezing fabricators to manufacture parts better, faster and cheaper. But what if we could press pause on production for a moment, step away from the stresses of modern metalforming, and take an educational mini-vacation to the Warren Lasch Conservation Center (WLCC) at the Clemson University Restoration Institute in North Charleston, South Carolina?

There, senior archaeologist Michael Scafuri and a staff of conservators and archaeologists are painstakingly unraveling a 150-year-old maritime mystery. The plot? It was the height of the American Civil War. The place was Charleston, South Carolina. Metalworkers—blockaded from supplies by Union ships—crafted a combat submarine from cast and wrought iron for an audacious mission that changed the course of naval warfare.

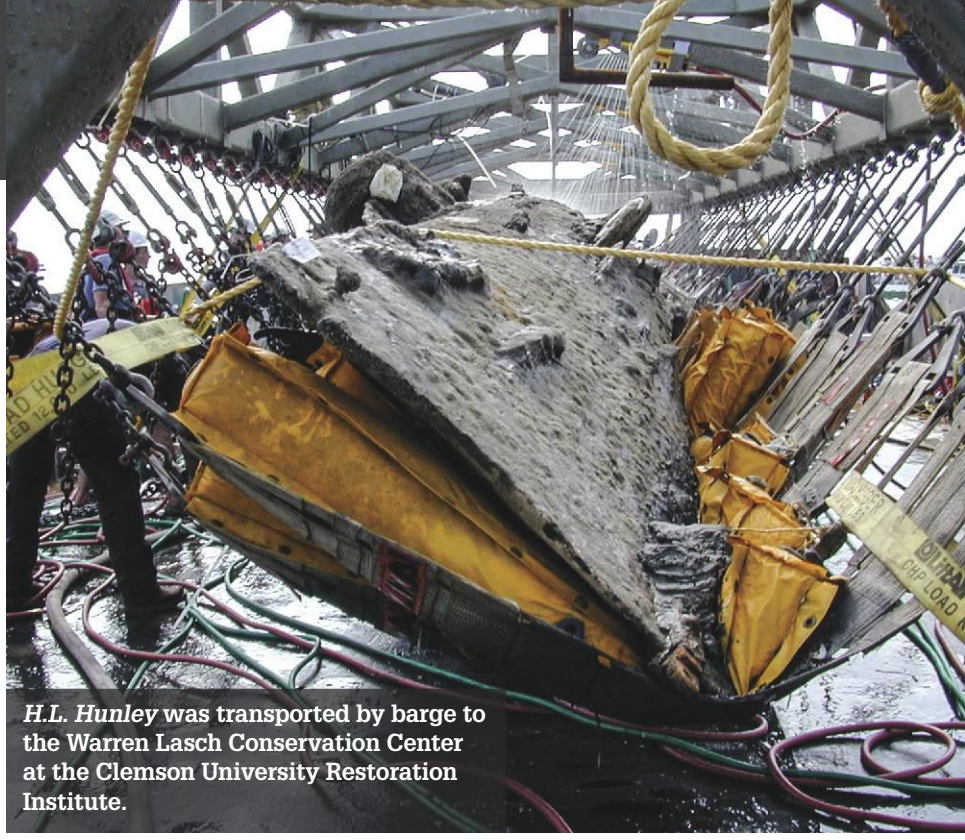
H.L. Hunley penned its opening chapter on Feb. 17, 1864, when it became the world's first attack submersible to sink a ship. The Confederate submarine, armed with a 16-ft.-long spar torpedo [a long spear with an explosive charge] loaded with approximately 135 lbs. of gunpowder, sank the steam screw sloop-of-war *USS Housatonic*. After unleashing its lethal blow, *Hunley* and its eight-man crew disappeared beneath the waters without a trace.

What happened to the vessel and its submariners remained an enigma until 1995 when American adventure novelist and underwater explorer Clive Cussler and his National Underwater and Marine Agency (NUMA) located the missing vessel using remote-sensing equipment, side-scan sonar and a magnetometer. Submerged in approximately 30 ft. of ocean and entombed in sediment nearly 5 ft. thick in places, *Hunley* had never left the harbor.

Scientists perform the tedious job of removing marine concretion from the exterior.

A blast

FROM THE PAST



H.L. Hunley was transported by barge to the Warren Lasch Conservation Center at the Clemson University Restoration Institute.

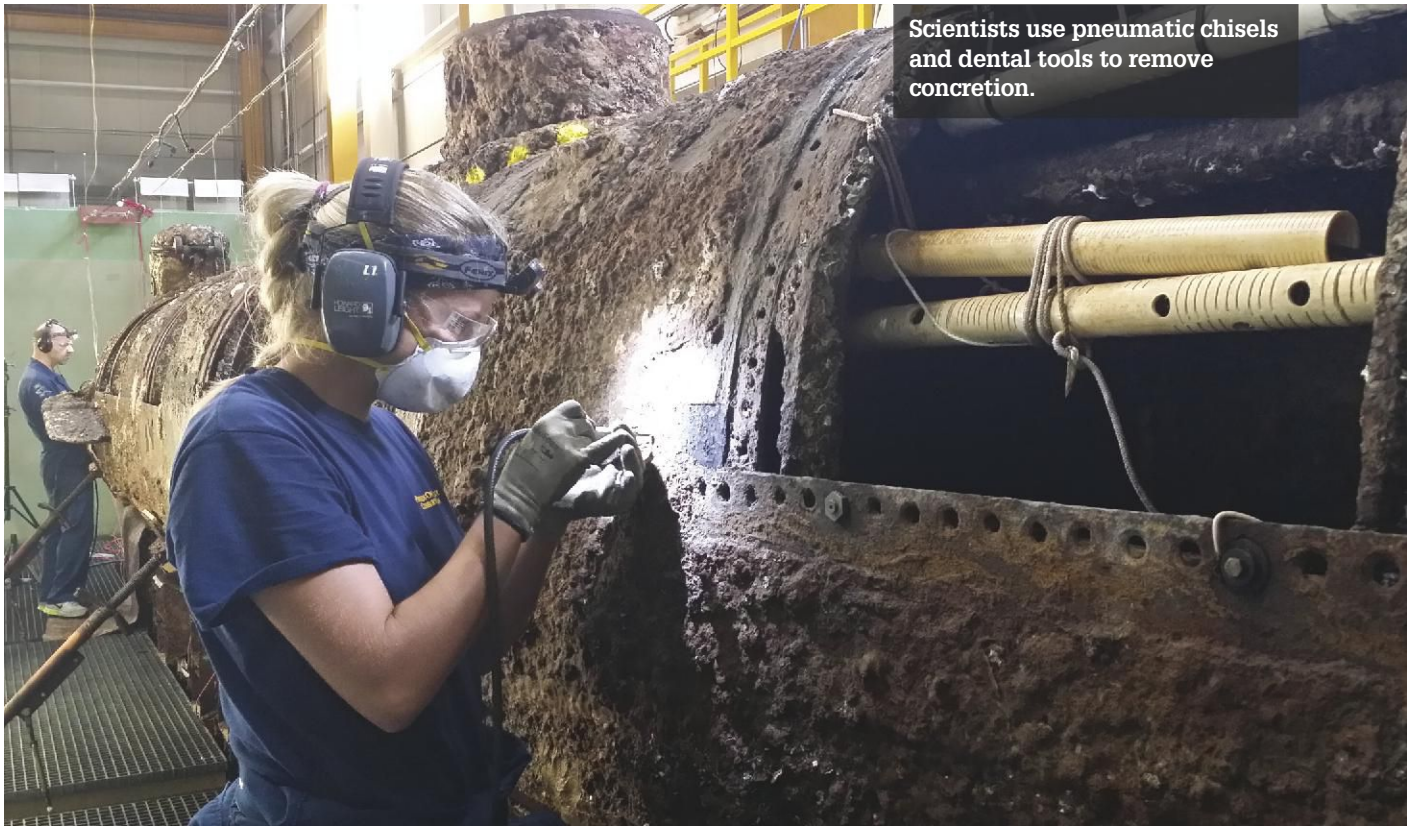
Raising *Hunley*

In 2000, after five years of meticulous planning, *Hunley* was raised and transported to WLCC, where it was immersed in a fresh water conservation tank. In 2001, the remains of the crew were recovered.

In 2014, scientists began the tedious, delicate job of removing nearly 11 tons of concretion —a mixture of shells, sand and corrosion byproduct—from the submarine's surface. They used small pneumatic chisels and dental tools. To further loosen its outer crust, *Hunley*'s bath was changed to a solution of water and sodium hydroxide. In September 2015, after 12 months of exacting manual labor, nearly 70 percent of *Hunley*'s exterior was visible for the first time.

Holes, scratches, damage and other items offered a roadmap of clues to as-yet unwritten chapters of *Hunley*'s story. Its iron skin also told a story about workers who grappled with time and intense pressures to create what underwater archaeologist Harry Pecorelli III called "a work of art."

> "We are attempting to understand a significant event in naval history."
>
> **Michael Scafuri**, Warren Lasch Conservation Center



Scientists use pneumatic chisels and dental tools to remove concretion.

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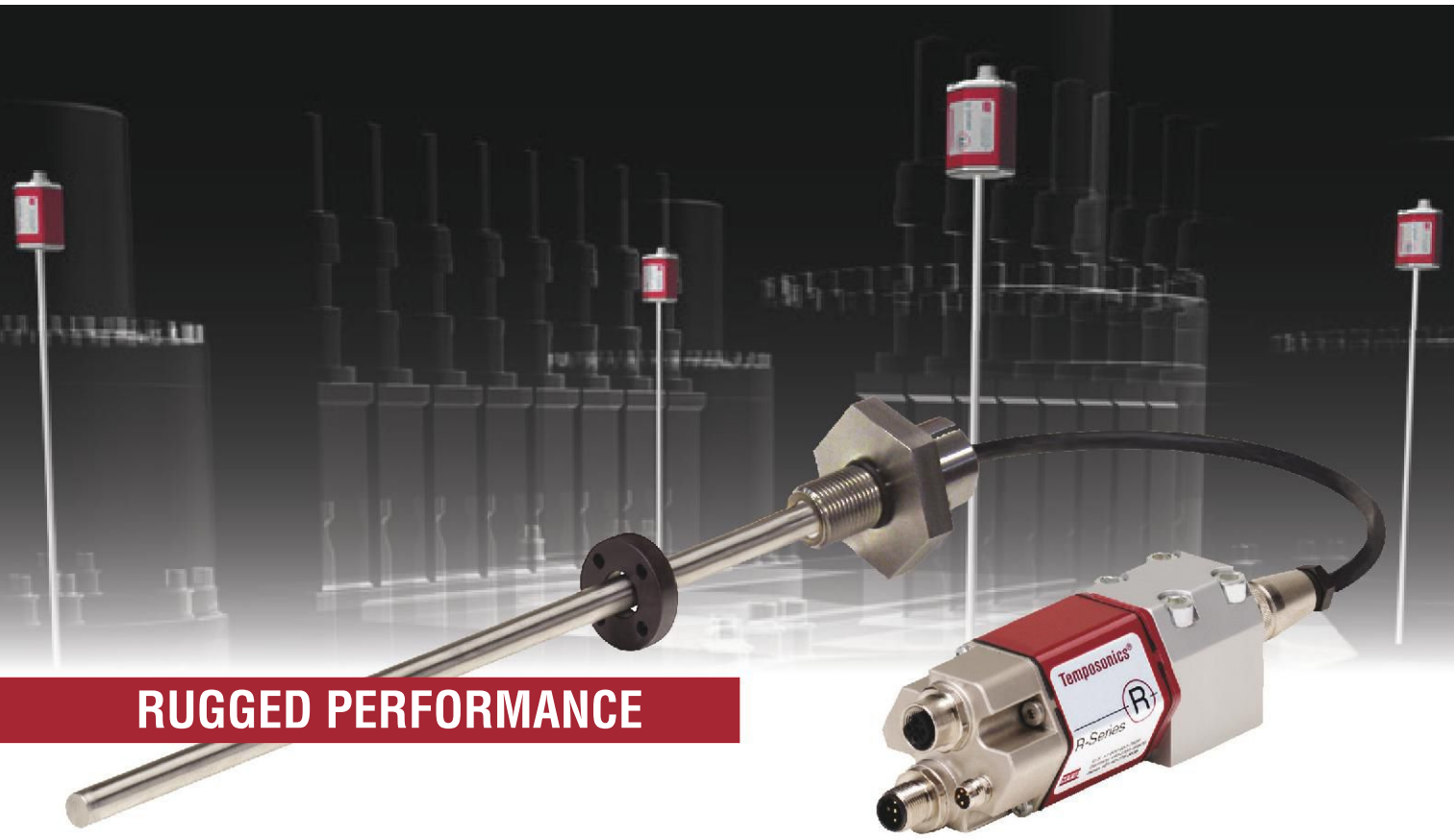

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The detached rudder of *Hunley* before [left] and after [right] conservation treatment.

At its core, archaeology is the study of the physical evidence of the past, says Scafuri, who also serves as adjunct professor of historic preservation at Clemson. "Through investigation we are looking to interpret events, to determine what the remains tell us."

Partnering with the Naval Surface Warfare Center, Carderock Division, to model, simulate and test the underwater explosion of *Hunley*'s torpedo, Scafuri may be able to determine its effects on both the ship and the submarine.

"We are attempting to understand a significant event in naval history," he says. "We want to know how and why eight men cranked an experimental craft four miles offshore to sink a ship. How did this event affect the war, if at all? And how did this event fit into the changes taking place to naval tactics and design at that time? This is the story we want to tell."

Vintage ironwork

Scafuri says he is also interested in the submarine's design and the goals of its builders. "Historical records are spotty but we know these metalworkers were under pressure with few resources. It seems logical they would just throw something together. Instead, they built a streamlined, elegant vessel that could cut through the water with its knifelike shape."

Since the late 1700s, rolling and slitting mills were capable of forming and cutting flat iron sheets or rails. Through the mid-1800s, blast furnaces remained an effective method for producing iron for casting. But the process of transforming cast iron into wrought iron remained woefully inefficient in the United States. According to historian David Landes, the

The hull interior was supported by half-moon shaped iron rings, joined with bolts and a slotted plate, tightened with wedges.

puddling furnace "remained the bottleneck of the industry," requiring men with a constitution strong enough to withstand extreme heat while stirring molten metal to catch and draw off globules of wrought iron that formed on the surface.

On Dec. 20, 1860, South Carolina became the first state to declare secession from the United States. The same year Tredegar Iron Works in Richmond, Virginia, became the third largest iron smelting operation in the U.S. and was a key reason the capital of the confederacy was relocated from Montgomery, Alabama, to Richmond.

Tredegar Works served as the primary iron and artillery production facility of the Confederacy. Hostilities began April 12, 1861, when rebel forces attacked Fort Sumter in South Carolina. In late 1861, the U.S. Navy blockaded ports like Charleston to prevent access to trade and goods needed by the Confederacy. The South also began to armor wooden ships with iron plate, a practice quickly followed by the North.

CSS Manassas was the first ironclad to enter battle in 1861 a year before *USS Monitor* arrived.

The cast and wrought iron *Hunley* measures 40 ft. long from the forward end of the bow casting to the aftermost point on the stern; 4 ft. high and 3.5 ft. wide amidships. "That's 12,000 lbs. of iron that could have been used to build cannons," Scafuri surmises.

A series of ⅜-in.-thick wrought iron plates were used to make the hull. Plate edges were carefully fitted up against each other and riveted to iron backing straps on the inside. Iron stiffening rings were installed to support hull pressure at depth. Scafuri estimates there are 42 plates.

Riveting story

Between the 1840s and 1940s, rivets were the primary fastener used in shipbuilding. The conventional hot riveting technique typically required three to four people; one to heat the rivets and then pass them to the "catcher," who inserted the rivet into the hole; a third fellow who hammered the rivet into the hole and the fourth, who held the rivet in place with a dolly.

"On *Hunley*, iron plate edges were beveled and the rivet heads hammered flush with the surface," says Scafuri. "This method allowed them to achieve a smooth outer surface and minimize drag. There were roughly 100 rivets per plate. The craftsmanship was superior. In order to remove plates to gain access to the interior, we had to drill through the rivets. We went through a lot of drill bits trying to drill through those rivets."

The bow was sculpted to a thickness of 1 in. A tapered keel was ballasted with iron blocks contoured to match the hull.

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Metalworkers achieved tapered ends by fashioning four narrowing rows of up to four wrought-iron quarter plates each. Quarter plates in these sections totaled 28.

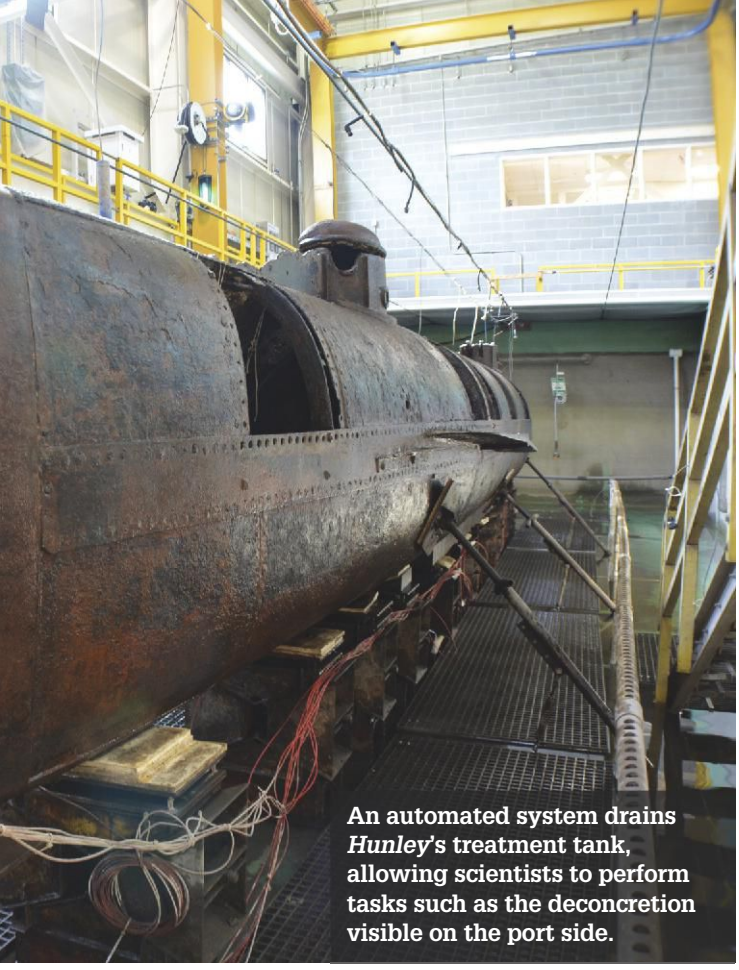
In an era before power tools—gas welding and cutting, followed by arc welding and resistance welding, wasn't developed until the late 1800s—*Hunley* shipbuilders instead cast complex components like the submarine's end caps and riveted them to plates. The availability of materials may have limited the submarine's size, but they also knew that the larger they built the submarine, the more slowly it would move, says Scafuri. Despite cramped quarters, seven of the crew turned an iron crankshaft attached to a propeller with three wrought iron blades riveted to a cast iron hub. "It's a smart design," Scafuri notes. "If any of the blades were damaged, they could be replaced without replacing the entire propeller." Addition of expansion strakes to the sides of the submarine's hull increased its interior headroom.

"With standard shipbuilding, mid-ship is your center point," explains Scafuri. "The keel, stem and stern post give you a skeleton. The submarine doesn't have a keel so we're using reverse engineering to try to determine how they laid it out. We hope to gain some insight into what they were thinking and why they did things the way they did."

Possibilities

Dive planes and remnants of other submarine components, including ballast tanks, are "evidence of the innovation and care of the submarine's designers and builders. We know they designed *Hunley* to dive because the depth gauge capped out at around 30 ft., which tells us how deep they intended to go," says Scafuri.

"The spar torpedo was produced in three pieces. A 3-ft.-long cast iron rod attached to the tang [a projection] at the



An automated system drains *Hunley*'s treatment tank, allowing scientists to perform tasks such as the deconcretion visible on the port side.

forward end with a yoke was inserted into a rolled, wrought iron pipe 6.5 ft. long. It was joined with a second wrought iron piece 6.5 ft. long. The tip of the spar contained a fragment of the copper sheathing used to encase the torpedo, which was bolted to the spar.

Finding the torpedo's remains at the end of the spar support the idea that it was not meant to come off the spar. For Scafuri and the others, a lot of research and analysis remains to be accomplished. But clues like the discovery of the spar and its pieces, the hull and the mechanisms the crew used that night unveil "previously hidden details" that Scafuri believes will prove essential to the group's investigation to understand what really happened to *Hunley* and its crew.

Were the submariners knocked unconscious by the shockwave of the explosion? Was the ship structurally damaged? Since the crew died at their stations, did the vessel simply run out of air? Deconcretion and restoration work on the submarine will take three to four more years to complete.

"Archaeology is the study of people and the lives they lived. How valuable this is to the present is subjective," Scafuri says. "But I do feel that making a connection with the past helps individuals put the present into perspective. It can be illuminating to learn about the lives of people 150 years ago, how they solved problems and how similar they are to us."

Perhaps fabricators today can find a similar kinship with metalformers like those who crafted *Hunley* with imagination and grit. FFJ

Friends of the Hunley, North Charleston, South Carolina, 843/743-4865, www.hunley.org.

BY LYNN STANLEY, SENIOR EDITOR

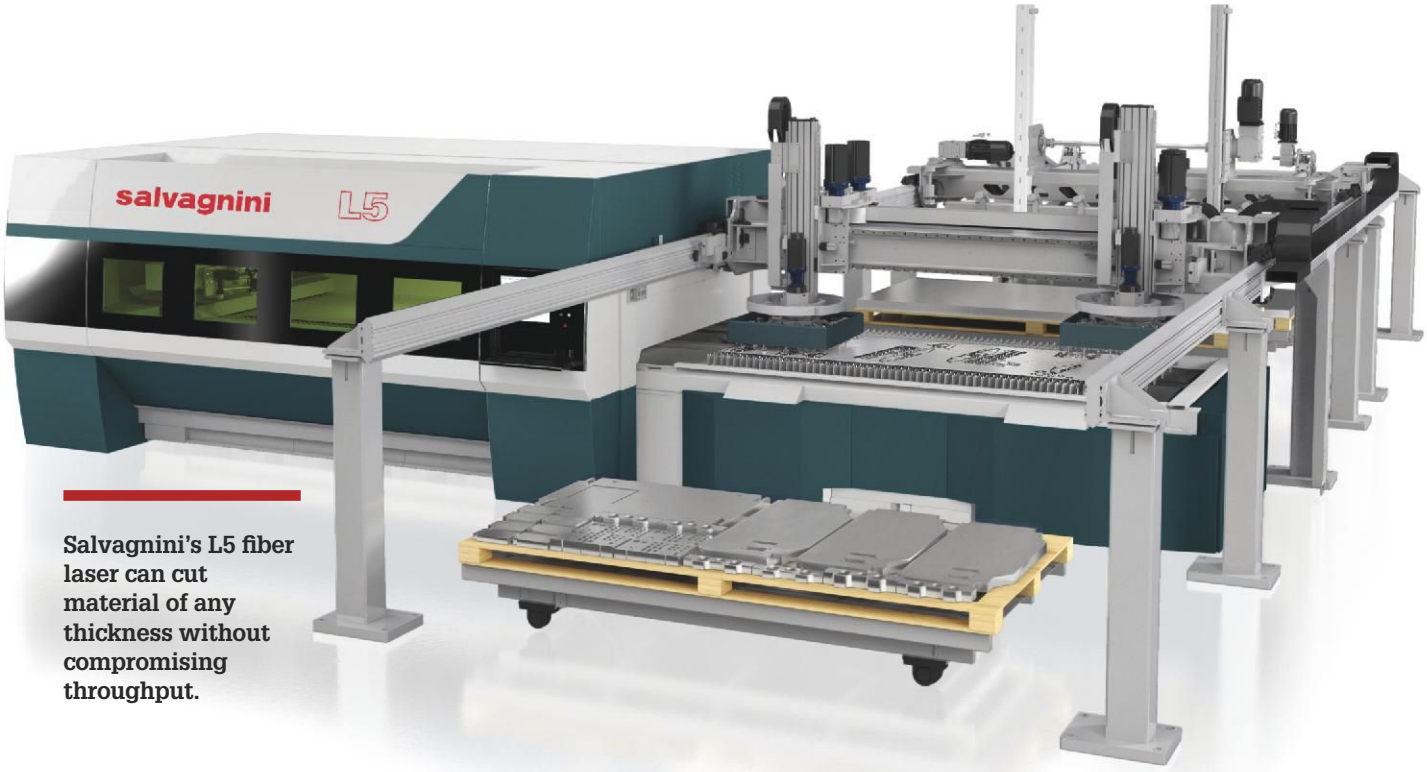
A patented airplane-like manipulator provides extremely rigid construction for stable positioning of the focusing head and precision cutting.

A higher power

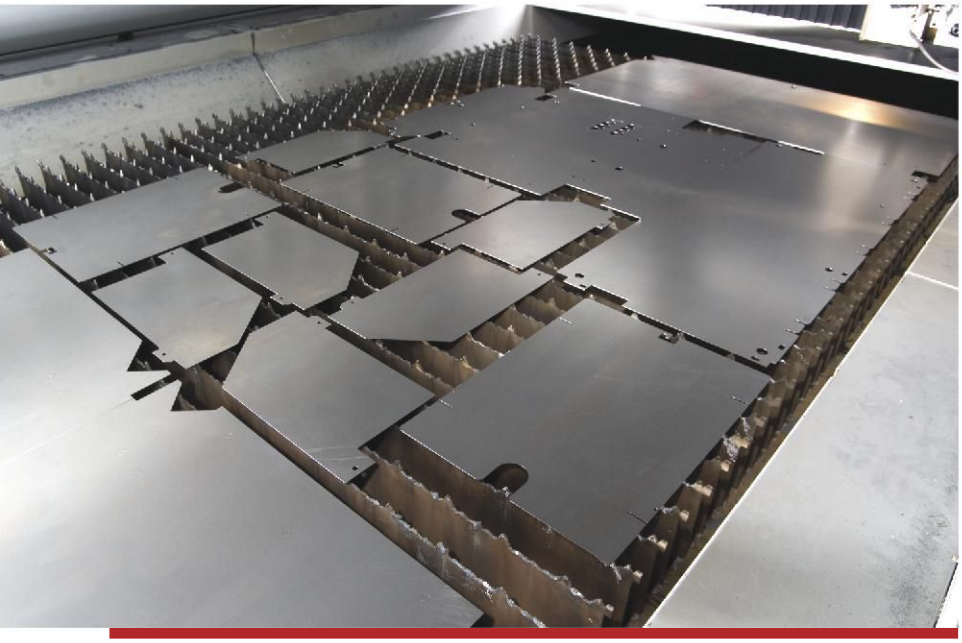
Manufacturers migrate toward automation for unmanned operations along with higher cutting speeds

The black art that once shrouded fiber laser light beam technology has been unmasked. Manufacturers are "over the newness of fiber lasers." Instead, these equipment owners are turning their attention to material handling and higher power for faster cutting. Hamilton, Ohio-based Salvagnini America President Bill Bossard explains. "Fiber lasers are no longer a mystery to the markets they serve," he says. "The equipment has now been adopted across the board by a wide range of markets."

The reasons are plentiful. Compared to CO_2, fiber laser machines' streamlined footprint offers less clutter. Removal of components like bellows, mirrors and beam path translate to reduced maintenance and the costs associated with consumables. With its fingers on the pulse of its customers, Salvagnini's list of upgrades for its L3 and L5 models is numerous. Recent advances include pierce detection, cut confirmation, edge sensing and automatic nozzle changing to



Salvagnini's L5 fiber laser can cut material of any thickness without compromising throughput.



Salvagnini's automation system includes unloading, separating and stacking parts as well as nozzle changes.

name a few. One of the first companies to develop and introduce fiber technology to the market, the forward-thinking OEM has also been a proponent of automation.

Salvagnini set the stage a decade earlier with its development and introduction of the MCL Cartesian Sorter/Manipulator. The equipment marked a milestone for manufacturers that previously had to rely on manual labor or robots to retrieve, unload and place parts.

"Over the last two to three years, I would estimate about 80 percent of our customers are talking about some form of material handling as opposed to five years ago when at least 50 percent of the manufacturers we talked to were thinking about investing in a stand-alone machine."

The L30 compact tower is Salvagnini's newest addition to its material handling line and was built specifically for lasers.

Analysis

As an educator, the OEM has been vocal about the benefits of equipping a fiber laser to pace itself. "What is noticeable to me is that customers have begun to be proactive about automation in terms of the machine configuration they want to invest in," notes Bossard.

One contract manufacturer discovered the value of automation first hand. Running a stand-alone L3 fiber laser, the company was interested in expanding its cutting operations with the purchase of a second machine. "We sat down and talked with them about their needs," says Bossard. "We conducted a time study analysis and recommended they consider a tower equipped with auto load/unload versus another fiber laser. Throughput tripled on a daily basis."

The migration of manufacturers toward automated loading and unloading capabilities with laser operations is growing as companies see the competitive advantages, "especially when they can run laser operations on second shift without manpower."

But the need for speed hasn't diminished either. Cutting speeds have increased significantly and cut quality has improved. "If I choose a higher power fiber laser so that I can cut material faster, then combine it with a material handling option, my machine is no longer paced by how fast the operator can unload parts and load sheet," explains Bossard. "For example, if it takes five minutes for an operator to pick parts, fold the skeleton and load sheet but the laser—due to faster speed rates—finishes cutting in four minutes, I'm losing production time [and dollars] because I'm not ready to cut."

The ability to feed more sheets with automation that can service a fiber laser table in two minutes so that the table is al-

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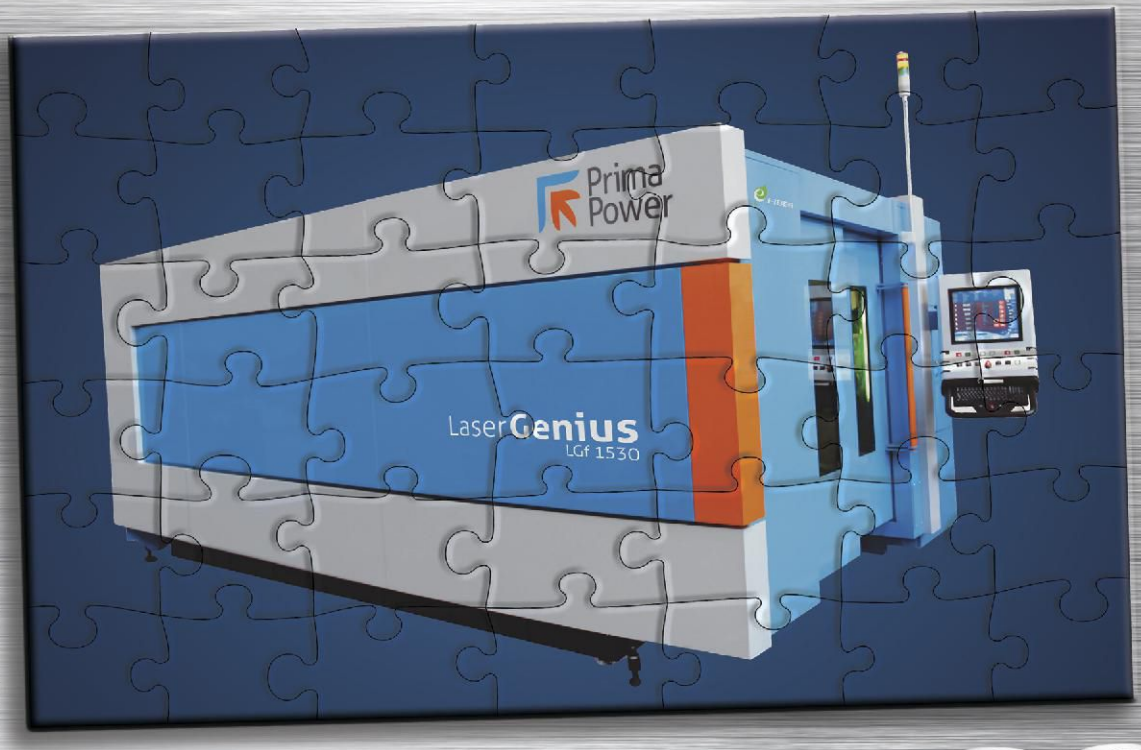

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> "I would estimate about 80 percent of our customers are talking about some form of material handling."
>
> **Bill Bossard**, Salvagnini

ways ready means the machine is pacing itself. Delays and bottlenecks are eliminated. But not everyone needs higher power, Bossard points out.

Tailored choices

"It's not a universal requirement," he says. "If you make light fixtures with the new LED technology, HVAC products or office furniture, higher power isn't going to buy you anything because of the relative thickness of the materials used to make these products. On the other hand, industries like contract manufacturing need the availability of faster cutting speeds because of the vast cross section of work that may come through the door."

Salvagnini's L3 fiber laser cutting system with a maximum of 6kW of firepower has the flexibility to cut thick or thin materials. The machine can perform as a stand-alone unit or a fully functioning component of a flexible manufacturing system with part unloading and scrap destruction and removal.

The L5 system has a single-optic focusing head that provides high-quality cutting for all material thicknesses without compromising throughput. Both fiber laser models use an airplane-like manipulator—it's patented—to achieve extremely rigid construction for stable positioning of the focusing head and precision cutting.

Both models can also be integrated with Salvagnini's automatic, system for unloading, separating and stacking parts. The automation system can be custom configured to support other systems downstream, making flexible, batch-one processing possible as well.

Applications dictate cutting speed requirements, but material handling is "becoming critically important for manufacturers as a whole. Everyone is looking for a way to produce more pieces per man-hour," Bossard observes. "Everyone is trying to move toward some type of unattended operation."

To tailor automation to the needs of the customer, Salvagnini starts with standard building blocks then begins to add technology and function that will fit floorspace and production requirements.

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Laser Technology

Bossard predicts in addition to automation, manufacturers will continue to demand higher power fiber laser applications. "It could mean developing new laser technology with beam shaping," he says. "It might also mean that developments are more laser-centric versus investing in machine advances."

One thing that won't change is manufacturers' goals to reach long-term operation on a continuous basis. For machine builders, Bossard believes each is tasked with the same goals.

"There are two things a builder can do," he says. "Provide customers with cost competitive machines to help them reduce capital equipment costs. And second, keep customers' machines running at an extraordinarily high rate better than anyone else. Anything else is just trimmings." **FFJ**

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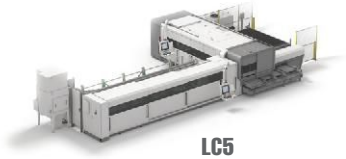

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Riding shotgun

Automation technology takes over the wheel to boost welding productivity and quality

Apple Pay, a Do Not Disturb while driving screen, and a new voice and "brain" for Siri are just some of the improvements that mobile device users anticipate this fall with the release of a major software update. Increasingly, consumers covet gadgets that can take a variety of tasks off their hands. When it comes to introducing the welding industry to technology advances like automation, the reception is somewhat less enthusiastic.

KAT welding carriage provides controlled, repeatable welds for overhead work.

"Manufacturing technology is not looked at in the same positive light as product launches from Apple—for several reasons," affirms Nick Drake, marketing manager for Gullco International. "In the field, automation is perceived as taking away a job instead of adding value, improving productivity and quality."

Heavy regulation of established welding procedures, and the high cost of making changes to those practices, sometimes hinders manufacturers from modernization. There is also the capital equipment costs associated with buying new equipment. As a result, many fabricators still "try to get by with manual welding operations."

A 63-year-old, Newmarket, Ontario-based company, Gullco has navigated these and other obstacles to forge a niche as a North American supplier of welding, cutting and beveling automation. Founded by Drake's grandfather, Mike Harris, Gullco primarily supports the shipbuilding, bridge construction, power generation and tank fabrication markets with its KAT, KAT II, KBM series welding carriages and KATBAK products.

Trending

"We don't sell welding equipment but rather the automation component that is integrated into welding equipment produced by major OEMs," Drake explains. "Our open architecture design means our carriages can be fitted to any manufacturer's welding system. That's been the intent of the company since its inception."

Drake points to several trends that have helped spur Gullco's growth. Following a

decade of overproduction, 2008 saw government funding cease, capital equipment and infrastructure purchases slow down and work flow dwindle. "Companies tightened their belts as a hedge against the financial crisis that impacted the supply chain," says Drake. "The modern manufacturing environment that emerged from the Great Recession dictated the need to produce less while increasing efficiency. This led to broader adoption of welding automation."

An aging workforce and the lack of "young blood" to fill the pipeline have also prompted companies to turn to automated welding for higher throughput and lower costs. "It's an option that is especially attractive for companies managing a large project that has fallen behind schedule," says Drake, "or for customers who want to bid on a project but are concerned that a lack of skilled welders might cause the job to lag behind or go over budget."

Operator uses welding system equipped with Gullco's Pipe KAT Automation Carriage on a pipe application in Israel.

Gullco KAT Oscillator welding carriage.

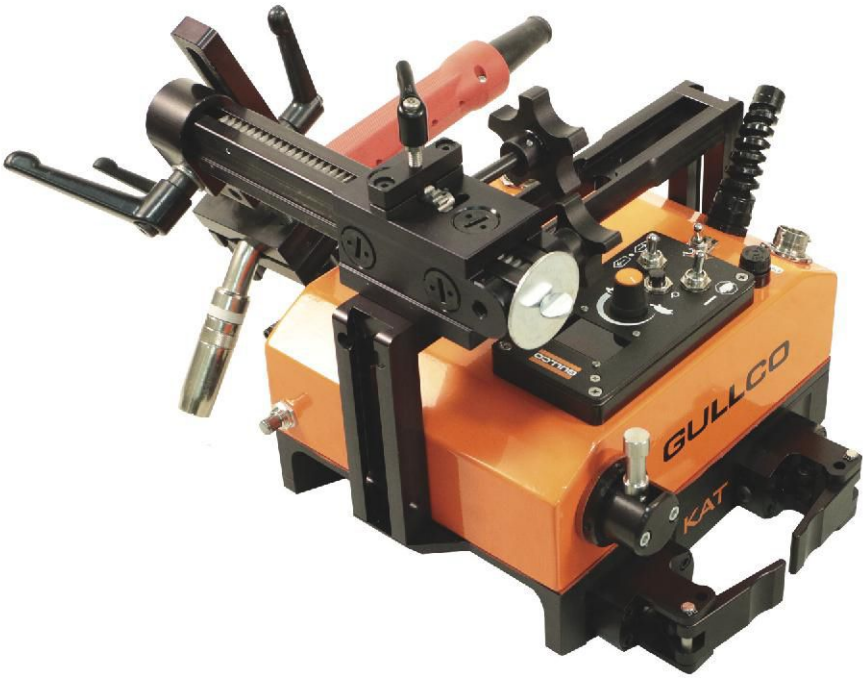
Worker uses Gullco MOGGY trackless welding automation carriage to produce a fillet weld on a ship hull stiffener.

The supplier has 15 product lines that each support hundreds of models. "Our equipment is not inexpensive, but the payoff is technology that can maintain the precise parameters a customer requires and do it again and again, day after day," Drake says. "We have eliminated the potential for human error and fatigue."

The durability of the equipment has been field proven. Gullco has documented the performance of carriages installed in 1971 that "still operate eight hours a day."

Drake credits the staying power of Gullco's products to that of the company itself. "During the financial crisis of 2008, a lot of companies moved out of Canada and the U.S.," he says. "We stuck to our guns and didn't move our operations to China. We stayed true to our roots and built off of that to provide a high quality product."

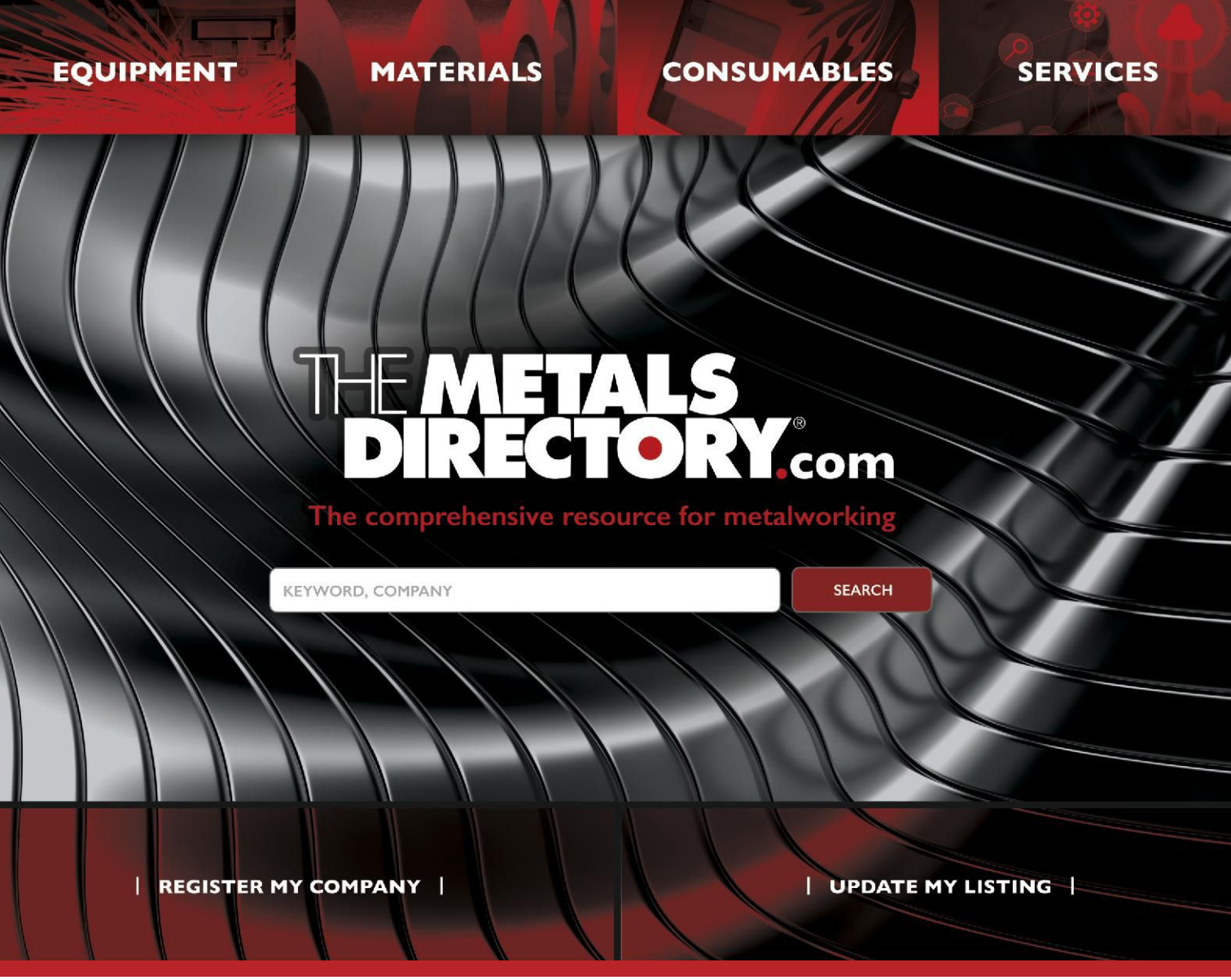
Easy to set up and easy to use, Gullco KAT products "take the welding gun out of the hands of the welder and put it in the equipment for high quality, faster welds." The KAT weld oscillation carriage takes variables like speed and pattern out of an operator's hand. "The individuals monitoring the weld are just making sure that the carriage's settings are producing the required weld," says Drake. "It is a little like a craftsman that goes from using a hammer and nails to screws and an electric drill. This is like power tools for welders."



Gullco's newest KAT carriage series has been reengineered to eliminate the need for tool setup.

Next generation

Gullco's newest KAT carriage series has been re-engineered to eliminate the need for tool setup. The ergonomic design supports a faster, lighter, easier-to-use carriage without compromising performance. Union regulations sometimes limit the amount of weight an employee can lift or carry. As a result, equipment sometimes has to be disassembled. On the other hand, there is concern that "lightweighting can result in loss of durability," says Drake. "The welding environment is very rugged. We didn't want to sacrifice the dependability of the unit by shaving pounds off. Our task over the last three to four years has been to work closely with the product to eliminate as much weight as possible while



2.0

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maintaining performance. It can be used and abused and still run great."

In addition to creating next-generation carriages, Gullco's investment in research and development is also aimed at attracting young people to the welding trade. Despite the success had by professional organizations and academia to improve the trade's image, Drake feels there is still work to be done.

> "We have eliminated the potential for human error and fatigue."
>
> **Nick Drake**, Gullco International

"My generation has veered away from this kind of career path," he acknowledges. "In my region, I think lack of funding to promote the trade in schools is part of the problem. If it is not promoted to students at a young age, if your high school doesn't have a program, then it's likely you won't be aware of it. You couldn't take a welding class in my school or my district. It was a craft that had to be pursued through a trade or secondary school."

Like a video game

Gullco is keeping pace with today's technology-based culture by using automation to reinforce the idea that welding is no longer a dangerous, dirty, manual job. "Operating our welding automation can be a little like playing video games," Drake says. "It also opens individuals' eyes to the world of welding. Typically stick welding is the photo everyone sees, but it is just a fraction of the types of welding being done."

Gullco will keep improving productivity with its products along with more efficient use of time and energy for different types of welds. Companies are spending cash on R&D to find methods to move the arc more efficiently.

"If you are performing weld oscillation on a vertical application like a tank seam, you are moving from the lowest to the highest point on the seam," says Drake. "This conventional approach lowers weld deposition because upward movement slows the weld puddle. Currently, a vertical weld technology is being developed that will allow the operator to weld from the top down to achieve a faster weld deposition rate. The more weld you can deposit in a short amount of time, the better [for the] bottom line."

As an industry, says Drake, "we need to look at improvements in manufacturing technology as a positive and not as a tool designed to threaten jobs. Jobs aren't going away, they will just change." FFJ

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BY LYNN STANLEY, SENIOR EDITOR

Pedal to the metal

High-strength materials and heavier parts aren't too tough for servoforming technology

In 1940, Henry Ford predicted, "…a combination airplane and motorcar is coming. You may smile, but it will come." If you ask Grant Group President Robert Grant about his new Aida DSF Series 200-ton direct-drive servoformer, his response is akin to that of someone who has seen Ford's forecast fulfilled.

"Imagine if your car could levitate and move off down the road," he says, describing his reaction to a demonstration of the press technology. Headquartered in Fraser, Michigan, Grant Group provides soup-to-nuts value-added stampings, clips and assemblies to the automotive industry. Three facilities totaling 240,000 sq. ft. house a gamut of stamping presses from 30 to 800 tons. Services include robotic welding and quality inspection.

The 53-year-old company was founded by Robert Grant's grandfather, Charles Grant. Its longevity, he explains, "has been built on a foundation of good, solid equipment and dedicated employees."

The high-volume supplier's throughput rates are boosted by the ability to run small parts at 300 SPM. When the Grant Group began to process heavier components, longer stroke requirements slowed production rates. "We were used to fast," Grant acknowledges. "We would go from 300 SPM on a 90-ton press to just 50 SPM when we moved bigger jobs to a 200-ton traditional press."

An operator uses step feed to test the die and watch the part form in real time.

It's in the programming

Servoforming was new to Grant Group but the machine's ability to dial up any type of stroke without productivity losses was compelling. An investigation of the technology led the stamper to Aida-America in Dayton, Ohio. The machinery builder supports servo-driven mechanical presses from 80 to 3,000 tons; mechanical stamping presses from 35 to 4,000 tons; and metalforming automation equipment.

Programmability and direct drive for full, continuous working energy at 1 SPM help Grant Group produce repeatable parts from hard-to-form materials.

> "The quality, speed and consistency of the Aida direct-drive servoformer make it the press of the future."
>
> **Robert Grant**, Grant Group

With the direct-drive servoformer, operators can program speed and position in a nearly unlimited number of combinations.

Conventional flywheel-driven mechanical presses lose energy at low speeds. The direct-drive servoformer can run at a velocity as low as 1 SPM during forming then regain full speed for the nonworking portion of the ram cycle to maintain productivity levels.

"Aida set themselves up as a servo leader and they have been doing it longer than anyone else," says Grant, who admits to being particular when it comes to equipment purchases. Citing a lesson learned from his father, he notes, "It's not about being cheap. It's about buying the right equipment the first time."

Installed last year, the Aida DSF Series

A challenging stainless steel automotive component is no match for Aida's direct-drive servoformer.

runs any size part the machine's 200-ton capacity and 72-in. bed size will accommodate, and allows Grant Group to achieve consistent, precision forming in exotic and high-strength materials.

"We do progressive die and light draw work as well as piercing," Grant explains. "We're also getting into materials we haven't seen before, such as dual-phase steel. Standard presses are having a hard time forming this and other high-strength low-alloy steels."

A large number of automotive components—seat belt and airbag components and door hinges—have been respecified. "We were having trouble producing these parts on our mechanical presses," Grant says. "We have been experimenting with the direct-drive servoformer by slowing the stroke near bottom dead center to produce these parts from grade 304L, a T-300 series stainless steel austenitic, which has a minimum of 18 percent chromium and 8 percent nickel." The result, he says, "has been consistent, superior quality parts."

Speed and position can be programmed in a nearly unlimited number of combinations.

Meeting demands

Automakers' multi-material strategy, using steel and aluminum alongside plastics and composites, will only widen, says Grant, and "the direct-drive servoformer gives us the flexibility to handle what may come down the pike."

Aside from part quality, turnaround times are getting shorter. Grant Group primarily serves Tier 1 suppliers. "Customers want everything cheaper and quicker," Grant observes. "If they could get parts yesterday, they would ask for them."

To manage part quality, the company designs and builds tooling in-house. The direct-drive servoformer "makes it that much easier." Manual step feed gives the operator control over the slide position. Die setup and tryout is available with full energy capability to 1 SPM.

"Before, we had to make sure we had the correct speed and the proper inertia to hit full tonnage, then its metal hitting metal very quickly," Grant says. "It made it hard to see what was happening inside the die."

The company now uses the direct-drive servoformer's step feed to test dies, according to Grant. "We're able to watch a part form under full tonnage and see everything happen in real time without worrying about the press locking up. One of the advantages to this is that engineers are able to see whether or not the forms are engaging properly." The engineers also can determine if the die is engaging at bottom or 5 degrees from bottom. "We're having conversations we could never have before," he enthuses.

The stamping press allows Grant Group to run dies faster than its other presses can. "It's primarily because they are able to program a shorter stroke length and run the press in pendulum motion with link motion," explains Rand Mellinger, sales manager for Aida.

One of the biggest changes for Grant Group wasn't mechanical. "It is about mindset," says Grant. "For us old-timers, watching the direct-drive servoformer in step feed mode with access to full energy and tonnage capabilities made us cringe at first. It's something that is just not done in a standard press." Forty years ago, parts were made with manual equipment, an extremely time-consuming process. "Today the quality, speed, consistency and repeatability of the direct-drive servoformer is spot on. It's the press of the future." FFJ

Aida-America Corp., Dayton, Ohio, 937/237-2382, www.aida-global.com.

Grant Group, Fraser, Michigan, 586-293-9200, www.grantgrp.com.

VOLUME
08

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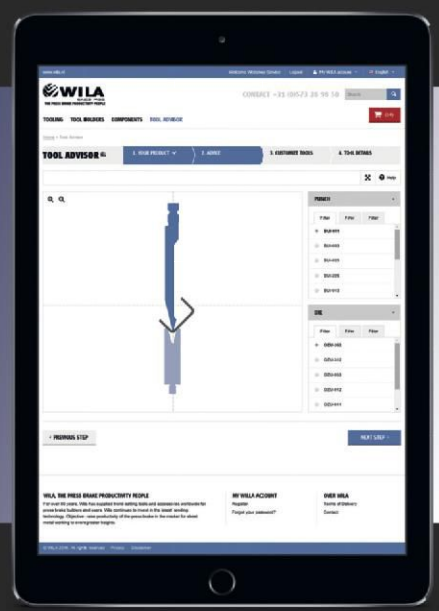

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BY COLIN LINNEWEBER, ASSISTANT EDITOR

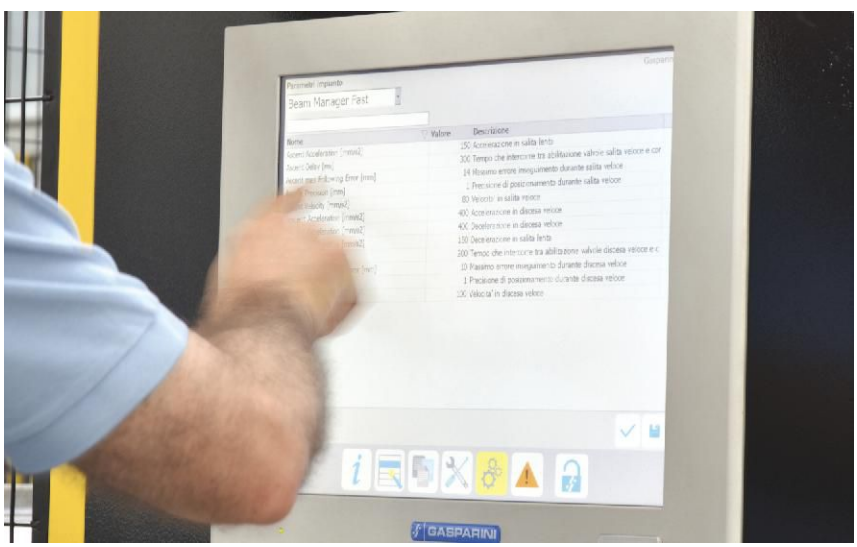
FLEXING MUSCLES

Automated bending line has athletic ability to manage large range of panel sizes with precision

The world's premier athletes—including marathon runners, wrestlers and weight lifters—assembled to showcase their skills at the 1960 Summer Olympics in Rome. Gasparini Industries, located in Treviso, Italy, roughly 335 miles north of the Eternal City, was established a decade following the event's closing ceremony in 1970. The company has since become a strong competitor in manufacturing and distributing commercial and industrial equipment for the sheet metal working sector.

In particular, the privately held company punches above its weight when building sheet metal bending, folding and cutting systems for a global clientele. Gasparini also offers machine installation, planned maintenance and other services.

CEO Andrea Guderzo says his company this year introduced its Industry 4.0-com-



Communication, reliability, material variability and data scarcity problems may be simplified by using Industry 4.0 technologies.

The 4.0 automated line allows manufacturers to employ different processes like coining, air bending and wipe bending.

> “The ability to manage panels of different widths and lengths, as well as the number of slots, is vital.”
>
> **Andrea Guderzo**, Gasparini

pliant automated bending lines. Equipped with a potent handling system and designed to reduce stoppages during sheet metal production. For example, communication, reliability, material variability and data scarcity problems may be simplified and solved using Industry 4.0 technologies.

The operational capabilities are ideal for fabricators of corrugated sheet and radiant panels that want to automate their output, Guderzo says. This automated bending solution will also suit any customer that struggles with multiple configurations and bending shapes.

“It automatically bends sheet metal panels in custom shapes and dimensions,” says Guderzo, adding that the machines are a flexible alternative to roll forming lines. “It continuously changes the panel size, the number of bends, and their distance. It can be reprogrammed and reconfigured remotely.”

For this new model, Gasparini developed a custom CNC that can be interfaced to the company ERP and technical office. “This way, manufacturers can upload programs and machine parameters of any dimension. All the while, it can be left to work unattended 24/7, 365,” he explains.

Custom configurations

The Industry 4.0-compliant automated press brake is available in any size and tonnage and it can be customized to fit a finished product. Accordingly, Gasparini’s automated bending lines can be equipped with all types of manipulators: conveyor rollers, belts and chains, manipulators, robots, clamps, rotators, and picking and positioning systems. Because of its recon-

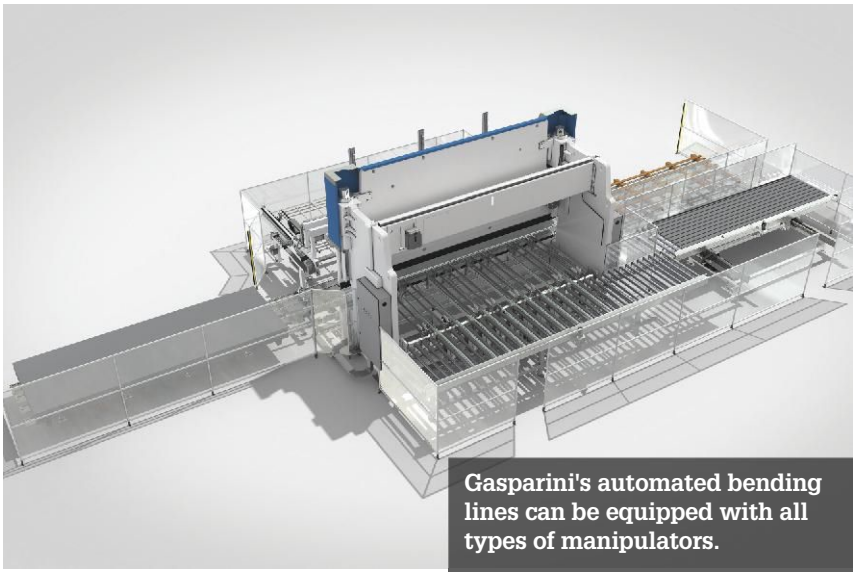
figurable punch and die feature, the 4.0 bending line allows manufacturers to employ different processes like coining, air bending and wipe bending.

"The ability to manage panels of different widths and lengths, as well as the number of slots, is vital," says Guderzo.

"The customized mold has a special automatic reconfiguration that lets it perform multiple types of bends. Any type of molds can be fitted to this bending machine, as well as automatic tool changing [systems]."

Specifying the machine's primary purpose Guderzo describes how—from raw materials to a completed product—the new model helps eliminate downtime. The increased efficiency can boost an entire supply chain.

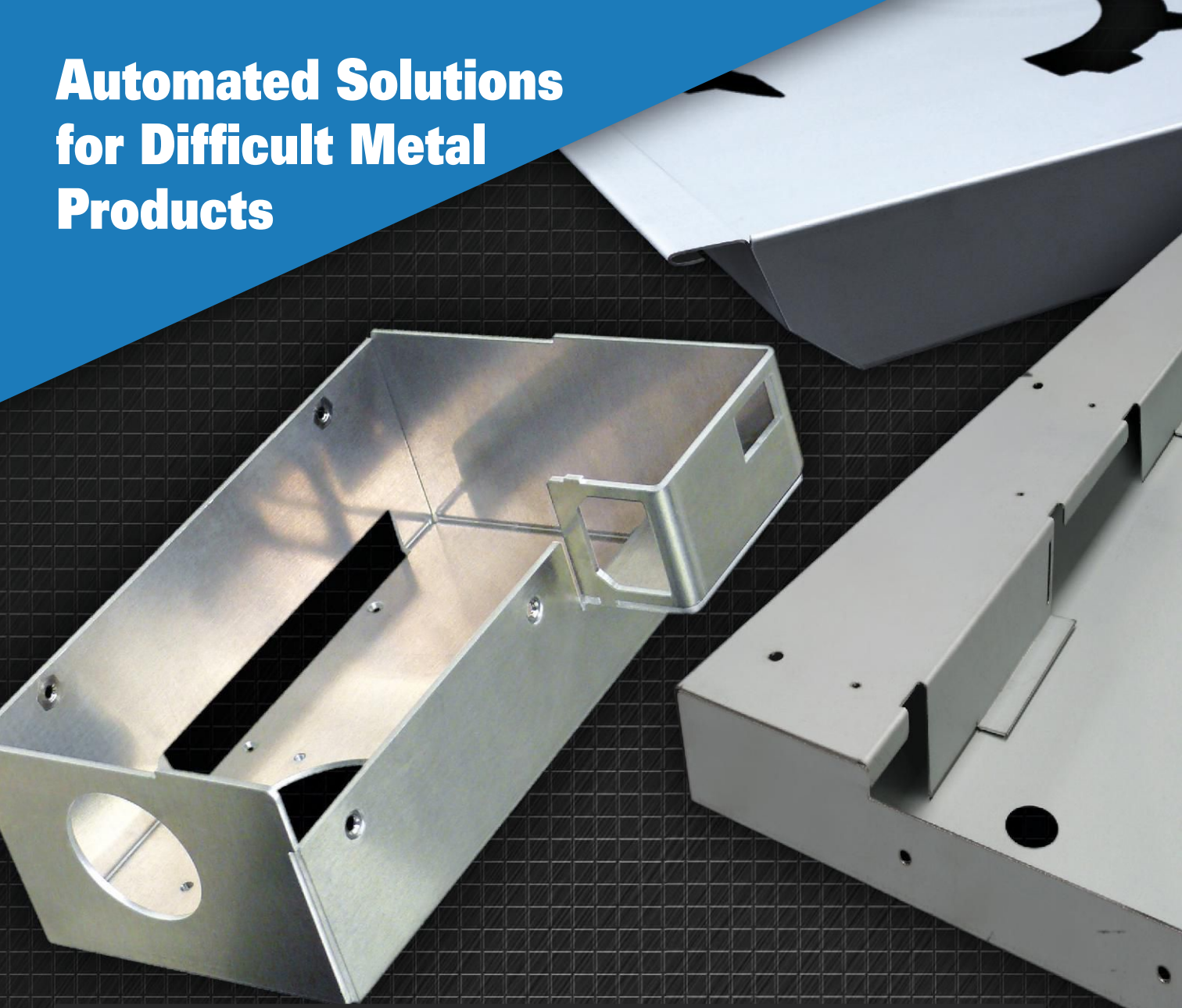
"The desired result is a part made within the target time, respecting tight tolerances and coping with multiple panel sizes and shapes," says Guderzo. "These results are achieved by means of accurate positioning, flexible machine configuration and programming, fast motors, servo drives and reconfigurable punches and dies."



Gasparini's automated bending lines can be equipped with all types of manipulators.

Machine stoppages often occur because companies are trying to carry out many production phases in masked time. But the Gasparini machine bends products that, until now, were made with roll forming lines. "If you wanted to change a product's shape, you needed to change the entire set of rollers," Guderzo says. "These tools are very expensive and changing the entire set of rollers is very time-consuming."

Automated Solutions for Difficult Metal Products



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Bending/Folding

Cost estimating

Industry 4.0 methodologies, which aim at eradicating bottlenecks and complicated processing steps, also helps consumers accurately calculate costs. Manufacturers can quickly, and precisely, estimate production prices and times while slashing waste. If faced with reduced workloads, resources may be reallocated to where they are necessary. Meanwhile, all usage statistics (uptime and downtime) are recorded, cycle times are tracked, and error analysis is conducted for a manufacturer's future reference.

"The machine, being completely sensorized, performs continuous analysis on the material characteristics," says Guderzo. "In this way, we can keep raw material under control and see if its strength, thickness or other factors are varying too much. It also keeps manufacturing efficiency at top levels because we can track tolerances, cycle times, errors, idle times, machine usage levels and more." Thanks to the continuous and extensive information flow, Gasparini can work with operators to "check for anomalies and perform predictive maintenance. In this way, we can address any potential issues before they lead to faults and unwanted downtime."

With the long-distance, high-hurdle performance the 4.0 automated bending line offers, it could become manufacturing "gold" for certain sheet metal production shops. FFJ

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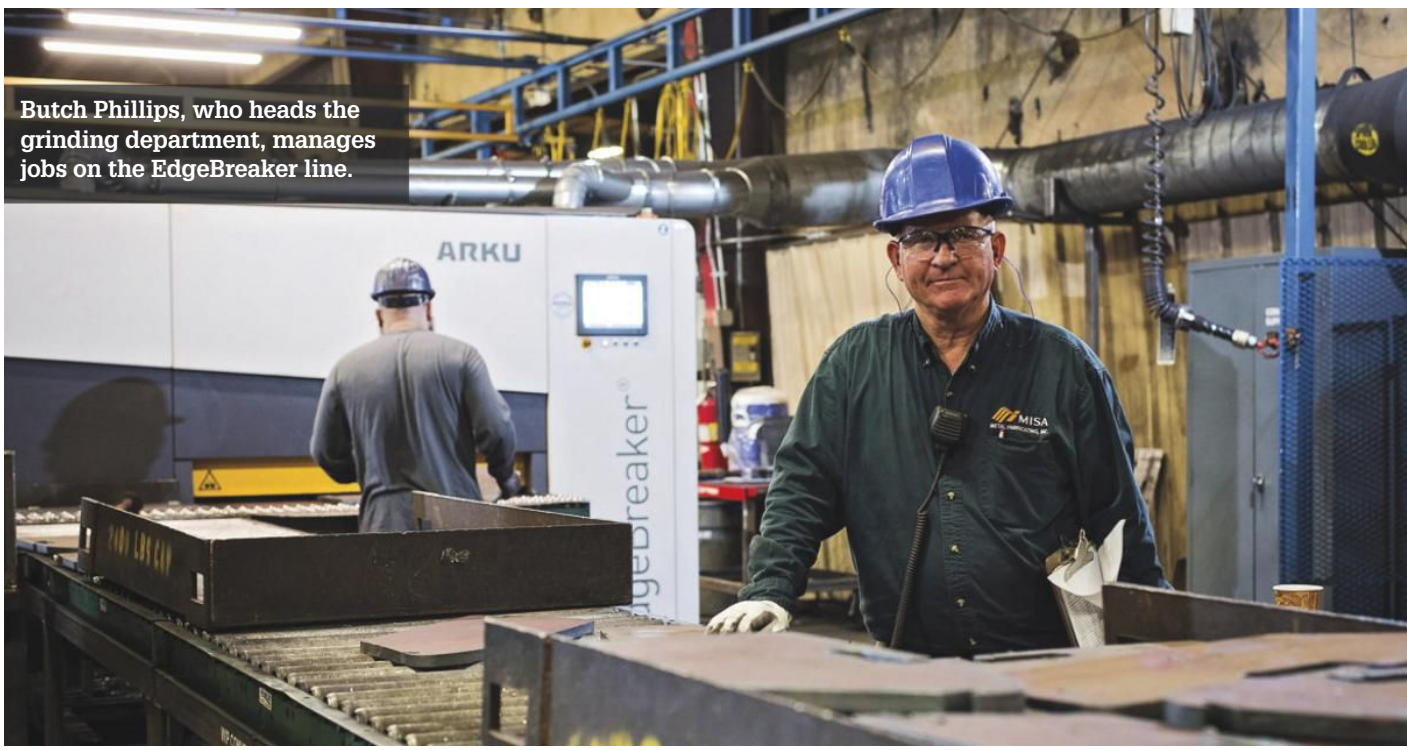
BY COLIN LINNEWEBER, ASSISTANT EDITOR

Economical EDGE

Plate fabricator makes quick work of finishing tasks with dual-processing system

Cincinnati is located approximately 100 miles northeast from Louisville. Considering the relatively short distance between the two cities, it was convenient for Cincinnati-based Arku Coil Systems Inc. and Louisville-based MISA Metal Fabricating Inc. (MMF) to work together to install a deburring and edge-rounding system.

The EdgeBreaker 4000 is a two-sided deburring machine capable of dual-sided rounding and deburring.



Butch Phillips, who heads the grinding department, manages jobs on the EdgeBreaker line.

A subsidiary of Marubeni-Itochu Steel America, MISA Metal Fabricating Inc. sought a quick-change system that can eliminate heavy slag and complete edge-rounding in a single process. Prior to installing Arku's system at its 166,000-sq.-ft. shop, MISA employees manually deburred material using angle grinders.

"I learned about Arku's EdgeBreaker at an industrial show about two years ago," MMF President Mike Talis says, adding that the shop routinely cuts and fabricates steel plate and sheet from between 3/16-in. and 4.5-in. thick.

MMF management conducted due diligence on the EdgeBreaker 4000 and were impressed with the machine's deburring test results, according to Talis. "They offered a better price compared to other brands and our geographical proximity sealed the deal."

He says the system improved the efficiency of MMF's material finishing workflow.

"This machine enhanced our output substantially and gave us a much cleaner atmosphere. The cleaner atmosphere came from the machine's quality air filtration system that contains metal dust particles."

> "[The EdgeBreaker 4000] is a very compact, economical machine that is also relatively easy to operate and maintain."
>
> **Mike Talis**, MISA Metal Fabricating Inc.

Overall, the EdgeBreaker 4000 "is a very compact, economical machine that is also relatively easy to operate and maintain," Talis continues.

Machine features

Based in Baden-Baden, Germany, Arku builds levelers, deburring and edge-rounding machines; and manufactures cut-to-length, slitting and press feeding lines for roll formers. The 90-year-old

company distributes and services its technologies to many customers from its facilities in Germany, the United States and China.

Denis Weinfurtner, Arku's North American marketing coordinator, says the EdgeBreaker 4000 was brought to the North American market in October 2015.

The dual-sided deburring and edge-rounding machine—whose standard footprint measures 112.8 in. by 84.4 in. by 87.3 in.—can simultaneously remove heavy slag and burrs from materials.

The parts storage feature allows an operator to keep and retrieve settings from previously produced parts. The EdgeBreaker 4000 is also equipped with a touch screen control panel and an automatic calibration feature for the grinding/edge-rounding blocks.

Charlie Fox, maintenance worker at MISA Metal Fabricating Inc., Denis Weinfurtner, North American marketing coordinator for Arku, and Mike Talis, president of MMFI, meet to discuss the new equipment.

The calibration feature ensures precise results regardless of the wear on the blocks, says Weinfurtner. It also has a patented click system that promotes time-saving replacement of grinding/edge-rounding blocks.

"The oscillation of the deburring drum allows for large burrs and heavy slag to be removed from materials, which delivers optimum deburring results," says Weinfurtner.

"Other advantages are that the grinding blocks can be changed quickly and easily and the system provides high abrasion and machinery performance."

While Arku's deburring and edge-rounding machine helps fabricators and manufacturers that consume clean-surfaced, straight-edged materials, it is especially useful for companies that cut material through laser, plasma and oxy-fuel processes.

"The machine is supposed to deburr and/or edge-round parts and sheets with heavy burrs, slag and/or sharp edges," says Weinfurtner. "The heavy slag is removed by a large grinding drum, which is more

suitable for parts and sheets with heavy slag. The edges are rounded by special rounding blocks within the machine."

The EdgeBreaker 4000 can improve production flow by limiting line stoppages, increasing worker safety, and bolstering the bottom line.

"With parts being slag/burr free, as well as with rounded edges (if desired), this allows for unnecessary downstream processing downtimes to be avoided," says Weinfurtner.

"Plus, there will be fewer injuries during material handling due to safe edges all around the part. It also allows for better paint adhesion due to rounded edges."

MISA Metal Fabricating Inc.—primarily serving companies that fabricate metal for water tanks, forklifts, building construction, agricultural equipment, crane and material handling equipment—has quickly adapted to the advantages gained by using the EdgeBreaker 4000.

While many factors contributed to MMF's decision to work with Arku, the companies' proximity cannot be overlooked. After all, galloping at peak speed, Secretariat could have galloped from Churchill Downs to southwest Ohio in roughly three hours. FFJ

Arku Coil Systems Inc., Cincinnati, 513/985-0500, www.arku.com.

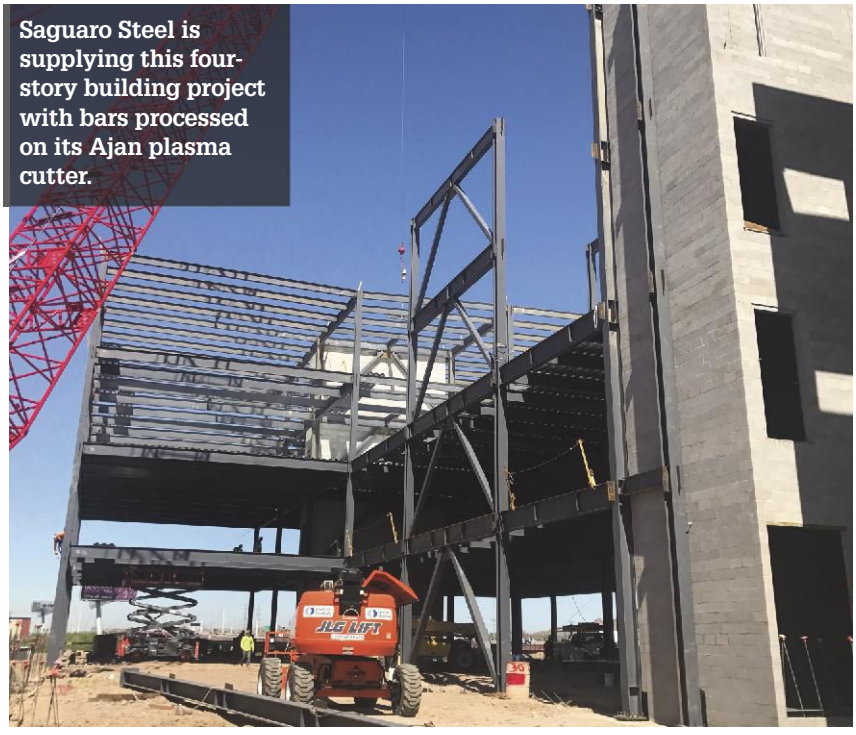
MISA Metal Fabricating Inc., Louisville, 502/933-5555, www.MISAMetalFab.com.

BY GRETCHEN SALOIS, SENIOR EDITOR

In-house advantage

Switching cutting methods opens up new realms of possibility

Leo Valerio finds himself combing through the rows of vendors at trade shows year after year to keep on top of plasma cutting and other metal fabricating technology to maintain Huntington Park, California-based Valco Precision Works' edge in the marketplace. "Our customers have a wide range of needs, including quick turnarounds on prototypes or varying order sizes," Valerio says. "We cut to size and keep plate in stock so we can do that cutting ourselves instead of shopping it out and losing days."



Saguaro Steel is supplying this four-story building project with bars processed on its Ajan plasma cutter.

Valco installed the Ajan line in house to avoid being at the mercy of another shop's production schedule.

> "For the first time in 31 years, we had plates waiting on beams."
>
> **Dave Terrell**, Saguaro Steel

From among all the vendors and machinery he researched, Valerio decided on an Ajan Plasmasonic 2500x6000 plasma cutter. In addition to plasma-cutting capabilities, Valerio liked that the Ajan allowed Valco to cut with oxy-fuel as well. "We have a 5-in.-thick blade with oxy-fuel and switching out takes only two minutes," he says.

Valco cuts windows into round tube as well as hot-rolled steel plate, serving the aerospace industry as well as job shops in material as thick as 5 in. For example, "We do a lot of cutting of 12-in.-diameter square tube," Valerio says.

Valco also welds together different sized boxes and structures using its plasma. This model also allows Valco to use the side 4th axis zone to cut pockets in round and square tubing. Since acquiring the Plasmasonic, Valerio says customers come to his shop with structural parts to cut as well as intricate designs on plate.

In business since 1984, Valco operates its shop one eight-hour shift a day, five days per week.

Valco fabricates all sizes and types of weldments. "By having the Ajan plasma, we are able to cut what we need when we need it," Valerio says. "We no longer lose time waiting for material delivery."

One-stop shop

Producing plasma machines since 1973, Ajan builds every component of its machinery from the plasma sources, tables and drives, to the fume extraction systems. Building everything in house provides the company with three distinct advantages. "One, it gives us much better control over the entire system, allowing us to maximize cut rates, cut quality, and consumable lifespans," says Angus Catterson, president of Kaast Machine Tools Inc., importer of Ajan

Saguaro's Dave Terrell says the plasma-cut material exceeds his accuracy expectations and readily handles intricate designs.

USA equipment. "Secondly, it gives us significant cost savings versus our competitors. Finally, if a machine needs service, our technicians are able to troubleshoot every single part of the machine. We never have to refer a customer to the plasma source or controls vendors, or to the software supplier," he explains.

"There is never any finger pointing. We built it, so we can fix it."

One of Valco's customers recently tasked Valco to cut detailed designs from plate to use on machinery control boxes. "We cut it up and gave it to them and they were surprised by how quickly we were able to turn it around," he recalls. "They later put in a larger order and we cut out the design for all their control boxes."

Ajan and Valco stay in contact, with Ajan offering refreshers or timely recalibrations of the Plasmasonic when needed. "If an Ajan technician is in the area, they make it a point to stop by to see how things are running with our machine here," Valerio says. "The tech will dedicate a day to us and during that time, our operators can bring up any questions where they are walked through it."

Valerio still performs due diligence. "I continue to visit trade shows," Valerio says. "Every year I check out what Ajan has going on as well as their competitors—and I continue with them because the machine itself and the people are fantastic. "

Ironworker ire

For 31 years, Saguaro Steel Industries LLC in Phoenix used a hydraulic shear/punch to cut flat bar and manually lay out to punch holes. "We used an ironworker," recalls Dave Terrell, general manager/principal. "Instead of cutting from plate, we would have our detailers change the plate into flat bar sizes: 2 in. wide to 12 in. wide." When fabricating large structural steel jobs, Saguaro would often have beams cut and waiting for plates to begin fabrication.

After three years of research, leadership at Saguaro Steel decided it was time to change the way it processed plate. "We began searching for a plasma table and Ajan came highly recommended," Terrell says.

Bringing plate cutting work in house has proven to cut costs and save time. "I found that when I tallied up how much I spent in handling flat bar stock and the cost of outsourcing all of our larger plates, it was time to expand our facility and make room for the plasma table," Terrell says.

In October 2016, Terrell ordered the Ajan 3000x6000 10 ft. by 20 ft. plasma table to serve its customers in the construction industry. Projects include industrial building construction, multi-story office buildings and residential contracts like custom homes and multi-unit apartments.

"We recently had a job with eight weeks to fabricate the steel before erection was scheduled to start," Terrell says. "One morning the contractor came to us and said it needed to happen in four weeks—and we did it, but there was no way that would have been possible without the plasma table. For the first time in 31 years, we had plates waiting on beams."

Saguaro has used the plasma to split I-beams, work that otherwise had to be outsourced. "Our accuracy has improved as well," he adds. "We are able to cut out graphic designs and the quality is even better than I expected."

Using the optional 5-axis head, Saguaro is able to cut bevels on radius. "We're able to make parts for the mining industry that were beyond our capabilities before," Terrell says. "If we need to cut 4-in.-thick plate using the optional oxy-acetylene attachment, it's a quick change-out."

Since switching to a plasma cutter, Saguaro's rate of plate processing jumped by 75 percent, says Terrell. "We probably get through about 500 tons of steel plate per year," he adds. "The nice thing is that now all of that is controlled in house. We can control each step of the process." FFJ

Ajan USA, Ardmore, Pennsylvania, 224/209-3833, www.ajanusa.com.

Saguaro Steel Industries LLC, Phoenix, 602-272-8800, https://www.facebook.com/Saguaro-Steel-Industries-LLC-234799953241304/.

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BY LAUREN DUENSING, CONTRIBUTING EDITOR

Students from the Hinds Career Center work on a CNC machine at Red Gold in Elwood, Indiana, helped by two company executives involved in the A+ Partners program.

Core strength

Group helps ensure enthusiastic people obtain the skills needed to succeed in demanding manufacturing jobs

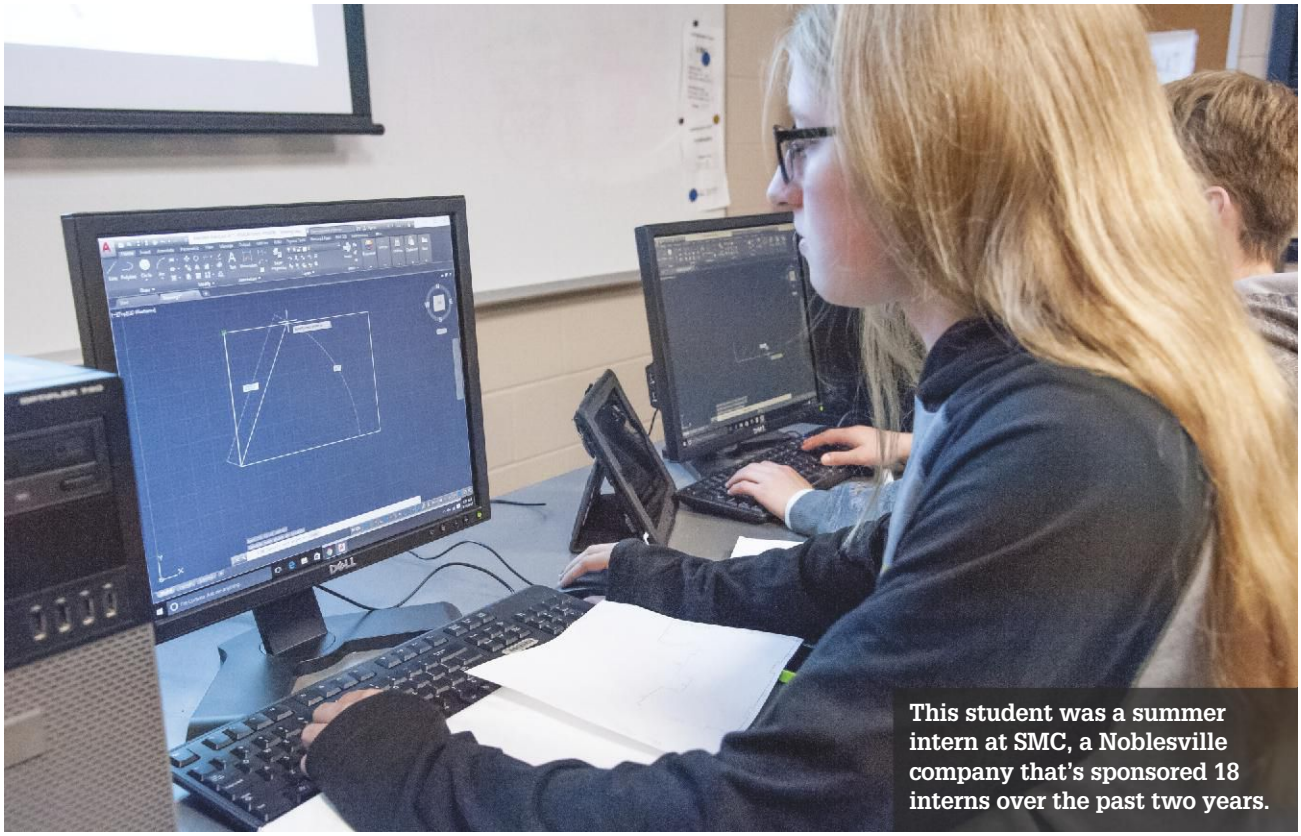
Indiana is a leading state for manufacturing activity and manufacturing job creation, according to "Manufacturing and Logistics: A Generation of Volatility and Growth." The report was released in June by the Ball State Center for Business and Economic Research and Conexus Indiana.

Contrary to popular perception, the numbers for the entire industry were strong: 11 percent growth "since the dot.com bust (2000-03) and the ensuing economic turbulence of the 2001 and 2007-09 recessions." And, in Indiana, a state where tax incentives have helped to lure investments by large employers, manufacturing production grew 41 percent over the same period.

Indianapolis-based Conexus Indiana celebrated its 10th anniversary in June 2017. Its parent is the Central Indiana Corporate Partnership, which has several branded initiatives to improve the state's economic climate for a variety of sectors, including life sciences, IT, emerging energy, manufacturing and logistics.

Shortly after it was formed, Conexus Indiana assembled a task force of executives to determine the skillset workers needed to be successful, says Claudia Cummings, vice president of Workforce and Strategic Initiatives. "We focused on middle skills because more than 50 percent of employment in manufacturing is middle skill, and that is where we had our most significant gap. Students either tend to stop with a high school diploma or less or go on for a four-year degree."

Conexus Indiana drafted a skills map reflecting the core needs of manufacturers, regardless of their subsector or size. "What we found, honestly, was that there were [a few] core areas where companies wanted to see some strength built while students were still in high school: Safety,



This student was a summer intern at SMC, a Noblesville company that's sponsored 18 interns over the past two years.

quality, environmental impacts and continuous improvement," Cummings says.

The state Department of Education used the Conexus skills map to develop standards for all Indiana schools that offer manufacturing-related curricula, Cummings says. But many schools didn't have the resources necessary to implement the program consistently across the state—and that's how Hire Tech was born. Hire Tech combines classroom instruction with real-world experiences, teaching students concepts beyond basic machine operation and encouraging them to understand the importance of productivity and continuous improvement.

> "More than 50 percent of employment in manufacturing is middle skill, and that is where we had our most significant gap."
>
> **Claudia Cummings**, Conexus Indiana

Education for all

Hire Tech uses an online textbook so that every student enrolled in the program is learning the same lesson at the same time, Cummings says. Students complete projects that are designed so that a wide variety of schools can implement them.

"It was important to us to make sure there was no specific equipment required for the class because we needed it to be scalable," she says. "If we're going to be able to hit anywhere near the numbers that we need to meet our demand, we need to have as many students as we can moving toward these careers."

"Traditional career and technical education centers with robust manufacturing labs can implement a quality, safety, blueprint-reading project using their equipment," Cummings continues. Alternatively, a small charter school can use common household items as instructional tools.

She cites first-year students taking on a year-long project focused on designing for production. The students are responsible for the entire process—designing the product, writing standard operating procedures, determining quality measures, putting safety requirements into place, and having an outside individual test that the SOPs are replicable.

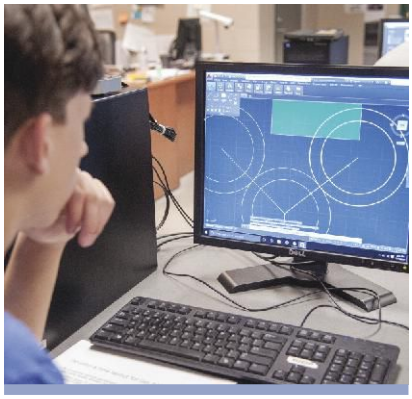
"I've seen schools use their wood lab to create dog houses for the Humane Society or memory boxes to sell. I've also seen traditional high schools with budgetary constraints have students work on slingshots or jewelry-making," Cummings says. Regardless of the end product, these types of projects teach students "how to be accountable to one another and how to communicate with each other—all those 21st century skills that we know are important to manufacturers."

Finally, Hire Tech schools are matched with at least one industry partner that serves as a mentor to both teachers and students, ensuring that projects are being "implemented in a way that's valuable to the local manufacturing ecosystems," Cummings says.

From internships to careers

Over the two years of the program, Hire Tech students can earn up to 15 college credits from Ivy Tech Community College (which has multiple locations), and they can earn up to five industry credentials from the Manufacturing Skills Standards Council (MSSC) and APICS.

Safety and quality content from the MSSC is offered to students at more than 200 Indiana high schools through Hire Tech. Students who successfully complete MSSC's Certified Production Technician Safety exam and MSSC's Certified Production Technician Quality exam will have sufficient safety and quality education



Since 2012, Hire Tech has prepared more than 7,000 students for high-tech careers, including this teenager from Noblesville High School.

to begin a middle-skill career in the advanced manufacturing industry.

The popularity of Hire Tech spurred the creation of the Conexus Interns program to "capture these students so they can be a direct pipeline into employment," Cummings says. The development process for the Interns program was similar to the one for Hire Tech and included an industry task force, which resulted in a step-by-step guide for manufacturers.

The Conexus Interns Framework explains the laws and insurance requirements regarding workers between the ages of 16 and 18 and discusses the work assignments that are "going to pique students' interest and add value to the company and encourage the students to persist into the career," according to Cummings. "The first year we had 80 students, the second year we had 220 and this current year we have almost 300 students as interns around the state."

As the industry grows and changes, so do Conexus Indiana's talent initiatives. This fall, Hire Tech will have completed its fifth year of operations. "We are completely refreshing the material to take into account changes in industry demand as well as in technology," says Cummings. Staying ahead of the curve will help Indiana continue to grow its manufacturing sector. "We have a lot of opportunity for individuals, and having a skilled, passionate workforce helps us continue to maintain our position as a leader in the industry." FFJ

Conexus Indiana, Indianapolis, 317/638-2104, www.conexusindiana.com.

Regional Manufacturing Outlook

MIDWEST

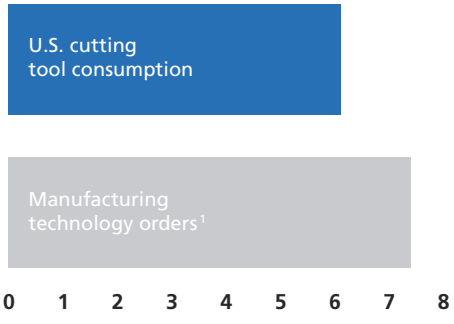
INDUSTRIES SEE GROWTH, FARM PROFITS SHRINK

The Chicago, St. Louis and Kansas City Federal Reserve Banks, which survey business owners, farmers and contractors about regional economic conditions, found signs of continued growth and some optimism. The Chicago Fed reports manufacturing inventories are at comfortable levels overall, though inventories at steel service centers remained low. Capital spending is expected to rise for the next six to 12 months, mostly to replace industrial equipment and renovate structures. The bank found sales for specialty metals producers are rising with greater demand from aerospace, energy and defense clients.

The St. Louis Fed reports several companies, including a metal fabricator and aluminum rolling mill, plan facility expansion projects. The agricultural sector, however, continues to operate under stress and some crop and dairy operations are folding or filing for bankruptcy, Chicago reports. The Kansas City Fed says farm revenues remain subdued as most agricultural commodity prices remained low. Corn and wheat prices are below levels generally thought to be profitable; but cattle and hog prices were on the rise due to strong global demand.

MACHINERY PURCHASES

PERCENT CHANGE JAN-MAY 2017 vs 2016
IN MILLIONS OF DOLLARS



1 Metal cutting, metalforming and fabricating equipment
Source: Association for Manufacturing Technology

AGRICULTURAL EQUIPMENT, UNIT SALES

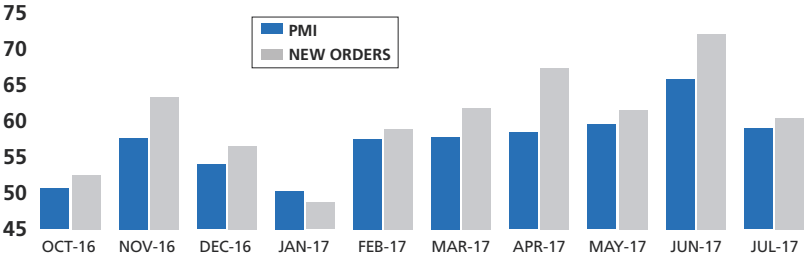
FARM TRACTORS & COMBINES
U.S. AND CANADA

JAN-JUN 2017
130,264

JAN-JUN 2016
121,526

Source: Association of Equipment Manufacturers

CHICAGO BUSINESS BAROMETER



Source: Institute for Supply Management-Chicago

UNEMPLOYMENT RATE

Rank	State	JUN-17
1	North Dakota	2.3
4	Nebraska	2.9
6	South Dakota	3
6	Indiana	3
8	Wisconsin	3.1
10	Iowa	3.2
16	Minnesota	3.7
16	Kansas	3.7
20	Michigan	3.8
20	Missouri	3.8
37	Illinois	4.7
42	Ohio	5

Source: Bureau of Labor Statistics

MANUFACTURING EMPLOYMENT

THOUSANDS OF PEOPLE

State	JUN-17	JUN-16	% CHG.
Ohio	686.4	684.0	0.4
Michigan	605.8	600.0	1.0
Illinois	574.3	574.2	0.0
Indiana	526.5	523.7	0.5
Wisconsin	472.0	464.1	1.7
Minnesota	320.6	317.3	1
Missouri	267.5	262.8	1.8
Iowa	214.5	213.8	0.3
Kansas	158.9	159.7	-0.5
Nebraska	96.7	96.4	0.3
South Dakota	40.8	42.3	-3.5
North Dakota	23.9	24.4	-2

Source: Bureau of Labor Statistics

EXPORTS OF MANUFACTURED COMMODITIES

IN MILLIONS OF DOLLARS

State	2016	2015	%CHG.
Michigan	$25,232.2	$22,926.4	10.0
Illinois	$24,025.4	$22,162.2	8.4
Ohio	$20,465.2	$20,019.6	2.2
Indiana	$16,823.7	$15,460.8	8.8
Wisconsin	$9,584.7	$9,014.8	6.3
Minnesota	$8,432.2	$8,019.0	5.2
Missouri	$6,153.6	$6,375.7	-3.5
Iowa	$5,488.7	$5,032.2	9.1
Kansas	$4,259.3	$3,581.4	18.9
Nebraska	$2,731.5	$2,553.0	7.0
North Dakota	$935.5	$884.0	5.8
South Dakota	$588.3	$563.3	4.4

Source: U.S. Census Bureau

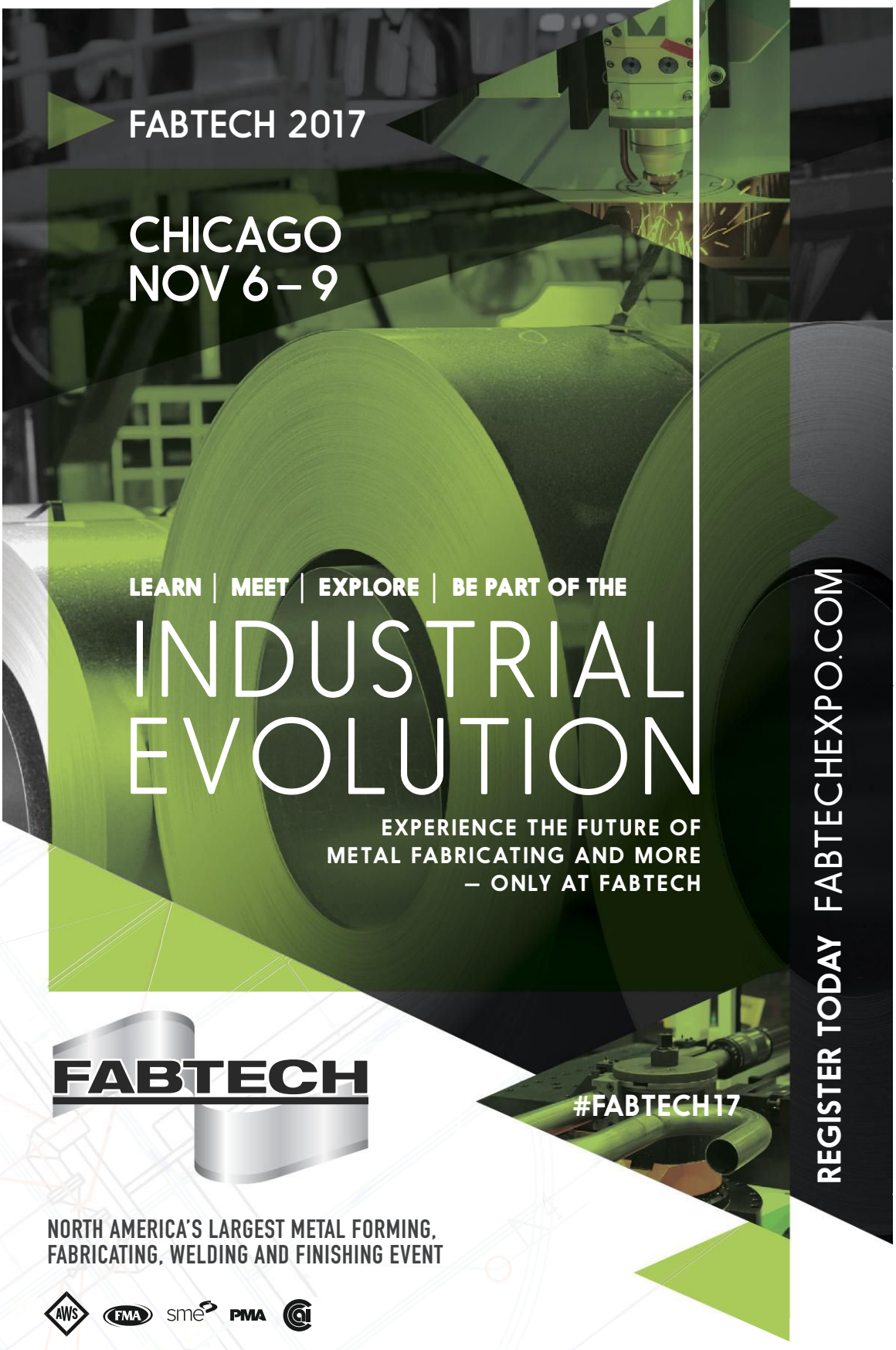
Classifieds

Flattening Software

Die Design Software

Machinery For Sale

Advertiser Index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STRESSED SKINS

Stressed Skins is a research project that explores the architectural potentials of robotic incremental sheet forming (ISF). Architects use thin metal sheets as cladding to provide integrated enclosure, structure and form. Because loads vary over such a building system, performance requirements also vary, and customized load-adapted panel designs can mean significant efficiencies, such as lower material usage. This project—led by **PAUL NICHOLAS** at the Centre for Information Technology and Architecture, Copenhagen—develops design, calculation and simulation methods, alongside fabrication parameters and workflows, that support customized design and fabrication using ISF. This includes the prediction of changes in material properties—such as thinning and work hardening—that result from forming each flat sheet into out-of-plane geometries, as well as the structural behavior of the overall assembly. Each panel of 0.5mm mild steel is formed by a robot linked directly to a 3D computer model. The pattern on each panel relates directly to the structural forces within it, with its local depth modulated in response to the local need for rigidity.

Photos: Paul Nicholas, CITA

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