the fabricator®

APRIL 2021 / VOL. 51 NO. 4

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One-click fabrication

How one shop automates the front office

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68 When automated deburring makes sense

72 A big control upgrade for a big press brake

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What happens when a fabricator automates the entire front office? It creates a new business model with tremendous potential for growth.

Cover photo courtesy of OSH Cut. An operator adjusts a nest of parts, delivered to the machine via OSH Cut's custom software.

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After one of the most challenging years on record and a year since the last Fabricators & Manufacturers Association Annual Meeting, metal fabricators and industry professionals took part in a virtual annual meeting where the focus was on what companies could do to take advantage of the opportunities in the post-pandemic world.



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Patrick McCarthy
VP of Business
and Eric Burger
VP of Operations
Metko Inc.



Located in New Holstein, Wisconsin, Metko Inc. is an industry leader in custom sheet metal fabrication. Since 1971, this family-owned business has served a diverse base of customers in a wide range of industries. Metko attributes much of their ongoing success to their partnership with AMADA, and consistent investment in industry-leading technology including one of the most recent acquisitions:

HG 1003 ARs Robotic Bending System — This fully-integrated solution is equipped with a 7-axis robot, Automatic Gripper Changer (AGC), Automatic Tool Changer (ATC), and patented AMADA tooling — providing unprecedented levels of unmanned productivity.

Patrick McCarthy, Metko's VP of Business, reflects on the decision to purchase the HG ARs, *"We were frustrated by the ever-increasing challenge of finding skilled workers. At the same time, we were preparing for our company's most strategic expansion. Consequently, we envisioned an environment with fewer operators monitoring cells of equipment — and we saw investing in AMADA's robotic bending technology as a logical step to get us to that point."*

The system's robust assortment of automated features combined with intuitive software, enable moving from one job to the next with unprecedented agility. In addition, Metko can now cost-effectively perform both small and large batch production with unmatched speed and repeatable precision.

To facilitate continuous production, an automated conveyor system was installed 13" below shop floor level. The sunken foundation lowers the height of the dual conveyors to ground level. As a result, material stacking height is increased without impacting the overall operating specifications of the robotic bending system.

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"We see where AMADA is taking technology and we want to be with them at the forefront of the curve."

— Patrick McCarthy
VP of Business

Intelligent Process Automation



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BUYERS' GUIDE

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WHAT'S ONLINE?

THEFABRICATOR.COM

Making mistakes means learning to fabricate. No one in a metal fabrication shop is perfect. Fabricators and welders shouldn't be afraid to make fixable errors and then learn from them, writes Detroit metalworker Josh Welton.

Find out the best way to cut through a shipping container. In the third edition of the Off the Grid blog series, the folks at Pacific Pines Ranch explain what techniques they used to cut through steel shipping containers as they continue building their container home.

Manufacturing takes off. Industry performance reports show that manufacturing is in a strong V-shaped recovery and continues to carry the economy out of the pandemic downturn. Metal fabrication remains a top-performing sector, writes Digital Editor Gareth Sleger.

COMING IN MAY

Metal fabricator celebrates 100 years in business. Laciny Bros., St. Louis, is an old-school job shop with a new way of approaching metal fabricating.

How to start and sustain 5S. The last S, sustain, is one of the most difficult to pull off. Lean consultant Gary Conner shows how to keep 5S going.

Improve your angle rolling. These tips will help structural steel fabricators avoid distortion when rolling beams.

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Time to end the tariffs on aluminum and steel

The metals industry got their time to reset; now it's time to boost the domestic manufacturing industry

What goes up must come down? It's inevitable. Unfortunately, when talking about steel prices, you can't really rely on any natural laws to determine when prices might return to recent historic levels. That's why the Section 232 tariffs need to go.

Right now domestic manufacturing is like a rocket that's about to lift off. Things are hot. Nerves are on edge. Everyone is waiting. Chris Kuehl, managing director of Armada Corporate Intelligence, told attendees at the Fabricators & Manufacturers virtual Annual Meeting on March 3 that the big banks are expecting 2021 GDP growth rates of around 6.4%. (You can read more about the FMA Annual Meeting on page 80.) Do you know how long it's been since the economy was humming at such a level? It's been more than 37 years since annual GDP growth surpassed 6%. (According to the World Bank, annual GDP growth for the U.S. reached 7.2% in 1984). Even growth in the 4.5% to 5% range would be a noticeable lift from the traditional rate of 2.5% GDP growth.

That rocket that's ready to take off, however, is struggling to leave the launch pad cleanly. The rocket is being weighed down. Steel prices have reached levels not seen since 2008. The Steel Market Update (SMU) reports that its benchmark price for hot-rolled steel was $1,270/ton in early March. That beats the previous high mark of $1,070/ton set 13 years ago.

"We're having a hard time passing on the increases," a manufacturer told the SMU analysts. (You can read more about this pricing surge in Steel News on p. 48.)

Of course, 2008 was a different time for manufacturers. Then everyone was riding high, enjoying the drug that was an inflated real estate market. Everyone knows how that story ended.

Today, however, the U.S. economy is in recovery. After a full year of pandemic living, the country's citizens are ready to live, work, and spend their money, both saved and incoming stimulus funds. Manufacturers need assistance to fully take advantage of the opportunities that await during what some are calling the new Roaring '20s.

That's why the tariffs need to end. Domestic manufacturers need relief for one of the major fixed costs for their businesses. They can't reinvest in their companies and reward their workers if steel prices keep increasing. Industry observers suggest that these high prices won't recede anytime soon as mill capacity goes offline at this most inopportune time and imported steel, now competitive even with the tariffs because of current high prices, can't get to U.S. shores quickly enough.

Remember that in 2018 former President Donald Trump enacted the 10% tariffs on imported aluminum and 25% tariffs on steel in the name of national security. (Section 232 of the Trade Expansion Act of 1962 allowed for such a move.) Let's just say that the steel industry put the last three years to good use.

New electric arc furnace (EAF) steel production capacity is coming online this year at Steel Dynamics' new, $1.9 billion flat-rolled mill in Sinton, Texas, and Nucor's $650 million mill in Ghent, Ky. Both are expected to add 6 million tons of steelmaking capacity per year. During his FMA virtual Annual Meeting presentation, Phil Bell, president of the Steel Manufacturers Association (SMA), Washington, D.C., said the steel industry is planning to spend more than $13 billion over the next three years to further enhance EAF steel production. (EAFs melt steel scrap to create steel products. They are looked upon as being a much more efficient way to produce steel when compared to more traditional integrated mills that rely on blast furnaces to produce hot metal typically from iron ore, limestone, and coke.) It sounds like the steel industry is ready to go.

Now it's time to let manufacturers and metal fabricators in the U.S. make the most of the moment. President Joe Biden should remove these government-imposed steel user taxes right now.

The 6.8 million people that work for steel-consuming manufacturing companies in the U.S. would appreciate the support. If three years of tariffs was good enough to protect the future of 140,000 in the U.S. steel industry, officials in Washington, D.C., should be able to recognize what removal of the tariffs will do for the domestic manufacturing base.

Dan Davis

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To learn more about FMA's CEC program and view a list of the current member schools, visit https://www.fmamfg.org/membership/schools.

To discover how your local community or technical college can become a member, call 888-394-4362 or send an email to info@fmanet.org.

CALENDAR OF EVENTS

Event information may be out-of-date due to the coronavirus (COVID-19). Please check with the event organizer for cancellations or date changes.

Virtual: **Geometric Dimensioning and Tolerancing Fundamentals 1**
April 19-20
ASME
800-843-2763
www.asme.org

Virtual: **Powder Metallurgy Machinability Seminar**
April 19-22
Metal Powder Industries Federation
609-452-7700
www.mpif.org

FabCast: **Introduction to Industry 4.0 for Fabricators**
April 22—10-11:30 a.m. CT
Fabricators & Manufacturers Assn.
888-394-4362
www.fmamfg.org

Value Stream Mapping
April 28—Golden Valley, Minn.
Manufacturers Alliance
763-533-8239
www.mfrall.com

GOLF4MFG South
April 26—Charlotte, N.C.
Fabricators & Manufacturers Assn.
888-394-4362
www.fmamfg.org

Spray Finishing Technology Workshop
May 6-8—Toledo, Ohio
Carlisle Fluid Technologies, Owens Community College
800-466-9367
https://cdn.owens.edu/workforce_cs/wp-content/uploads/sites/33/2020/10/Spray-Finishing-Brochure-2021.pdf

Virtual: **Steel 101**
May 11-12
Steel Market Update, CRU Group
724-720-1012
steelmarketupdate.com

12th International Aluminum Extrusion Technology Seminar
May 11-13—Orlando, Fla.
Aluminum Extruders Council
847-526-2010
ET-21.org

Design-2-Part Show
May 26-27—Atlanta
Job Shop Co.
800-225-4535
www.d2p.com

Stamping in an EV World
June 1—Plymouth, Mich.
Fabricators & Manufacturers Assn.
888-394-4362
www.fmamfg.org

Virtual and In-person:
ALAW—Advanced Laser Applications Workshop
June 1-3—Plymouth, Mich.
Fabricators & Manufacturers Assn.
888-394-4362
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Coil Processing Workshop & Tours
June 9-10—Michigan City, Ind.
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Executive Networking Event
June 10—Michigan City, Ind.
Association of Steel Distributors
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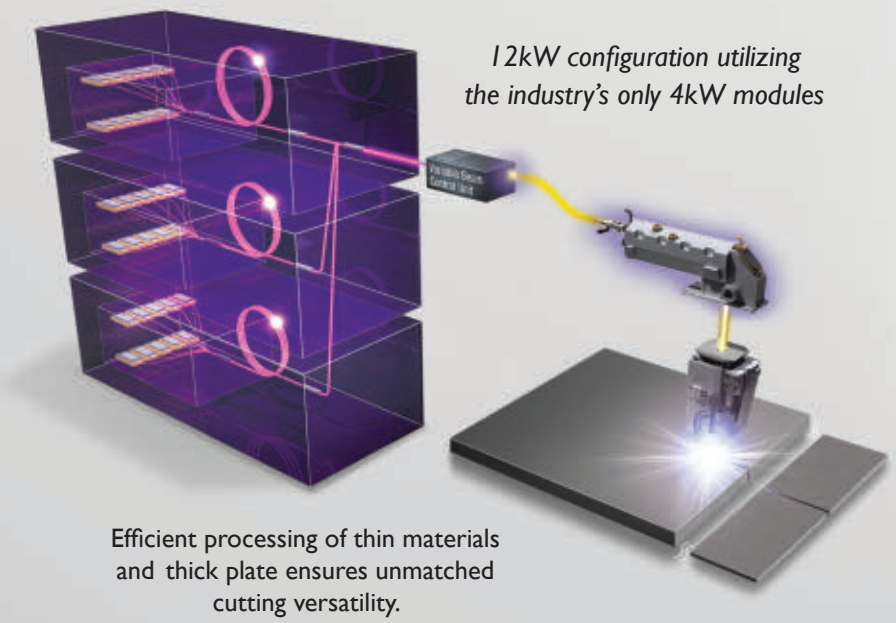
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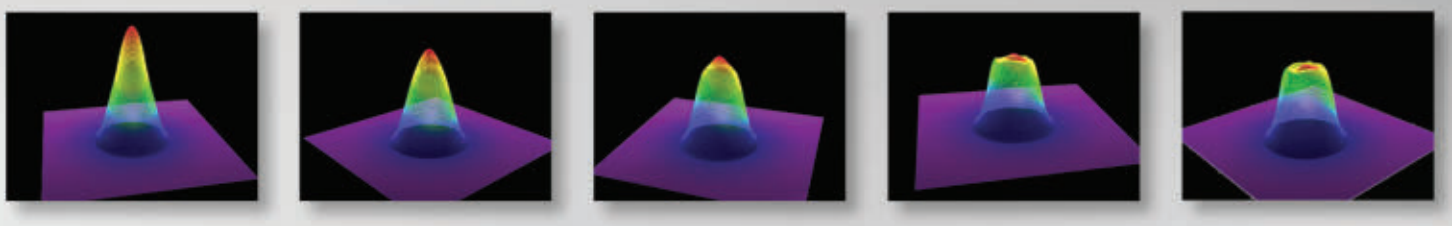
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CONVENTIONAL FIBER LASER



1/4" MS | 1" MS | 3/4" SS | 1/4" AL

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Call for Terminating the Tariffs

Editor's Note: On Feb. 10 the Coalition of American Metal Manufacturers and Users (CAMMU) sent a letter to President Joe Biden asking him to terminate former President Trump's Section 232 tariffs on steel and aluminum imports. CAMMU is an organization of U.S. businesses and trade associations, including the National Tooling & Machining Association and the Precision Metalforming Association, that represents more than 30,000 companies and more than 1 million American workers in the manufacturing sector. The following is a portion of the organization's letter.

… By taking action to terminate the Trump tariffs, your administration can prevent U.S. manufacturers from shutting down production lines, laying off workers, and potentially even closing their doors. By contrast, the ripple effects of allowing these Section 232 tariffs to remain are substantial. Our member companies report not only record steel prices, but also delivery times stretching 12-16 weeks, causing significant disruptions. Thousands of manufacturers cannot procure the necessary raw materials in the U.S. in sufficient and reasonably available commercial quantities—and of a satisfactory quality—leading American companies to rely on imports of steel and aluminum from many of our overseas allies.

The problems caused by the Trump tariffs cannot be resolved through the U.S. Commerce Department's broken product exclusion process. In its 2018 report to President Trump recommending the tariffs, the Commerce Department estimated that there would be 4,500 product exclusion requests from the steel and aluminum tariffs. The actual number of exclusion requests now far exceeds 200,000 and is growing, and the process has been plagued by delays, questionable decisions, and a complete lack of transparency. Numerous domestic steel producers continue to object to product exclusion requests and falsely claim that they can provide the steel product so that the exclusion is denied. Unfortunately, the Commerce Department recently proposed more burdensome changes to make it even more difficult for manufacturers to obtain a product exclusion. The exclusion process alone cannot address the shortages and price spikes that are hurting steel- and aluminum-using manufacturers.

More than 6.2 million Americans work in industries that use steel, while the steel industry itself directly employs only 140,000 workers (pre-COVID-19 pandemic data). The Trump tariffs primarily served to shift injury from one industry to a much broader segment of the economy. The data on employment in steel and aluminum production shows a muted benefit of approximately 1,000 more jobs. By comparison, a study by the Federal Reserve Board of Governors indicated that increased input costs due to the tariffs are associated with 75,000 fewer jobs in the U.S. manufacturing sector.

Numerous other studies provide evidence of the damage caused by the Trump steel and aluminum tariffs to our nation's economy, its small manufacturing businesses, our relationships with longstanding trading partners, carefully constructed supply chains—and, ironically, the very notion of "national security" itself, which was the premise under which this trade action was based. In fact, U.S. national security has been weakened by the supply disruptions and other market imbalances in once stalwart defense, automotive, aerospace, and other major industrial supply chains as a result of the Section 232 tariffs.

Rather than invest in new facilities, expand production capacity, and improve the health of the domestic steel industry, President Trump's steel tariffs simply allowed domestic producers to raise prices on their products by effectively placing an added tax on competing imports. As a result, even those manufacturers who only buy steel from domestic producers are unable to obtain the steel that they need because of the domestic industry's capacity, or are unable to purchase steel at a competitive price, placing them at a growing disadvantage with overseas competitors who pay lower global market prices for these materials.

The Trump tariffs have also imposed added costs beyond the manufacturing industries, as many U.S. trade partners, including the EU, have placed retaliatory tariffs on U.S. agricultural products and other exports.

There is a consensus globally that a unified effort is required to address the issue of excess steel and aluminum capacity in China now estimated to be 1 billion tons, an ongoing problem for the U.S. and our trading partners. At the end of the Obama administration and beginning of the Trump administration, negotiations were underway at the Organization of Economic Cooperation and Development (OECD), led by the U.S., to work together with our trading partners to address this challenge. These talks ended after the U.S. imposed Section 232 tariffs on steel and aluminum imports, leaving those structural supply issues unaddressed. The Trump tariffs have failed to address these issues by any measure.

It's time for the U.S. to put counterproductive trade policies in the past. We ask that you move at once to terminate the Section 232 steel and aluminum tariffs and focus instead on re-engaging with our trading partners on a coordinated response to address the root cause of global oversupply in steel and aluminum: excess capacity in China.

Paul Nathanson
Executive Director
Coalition of American Metal Manufacturers and Users
Washington, D.C.

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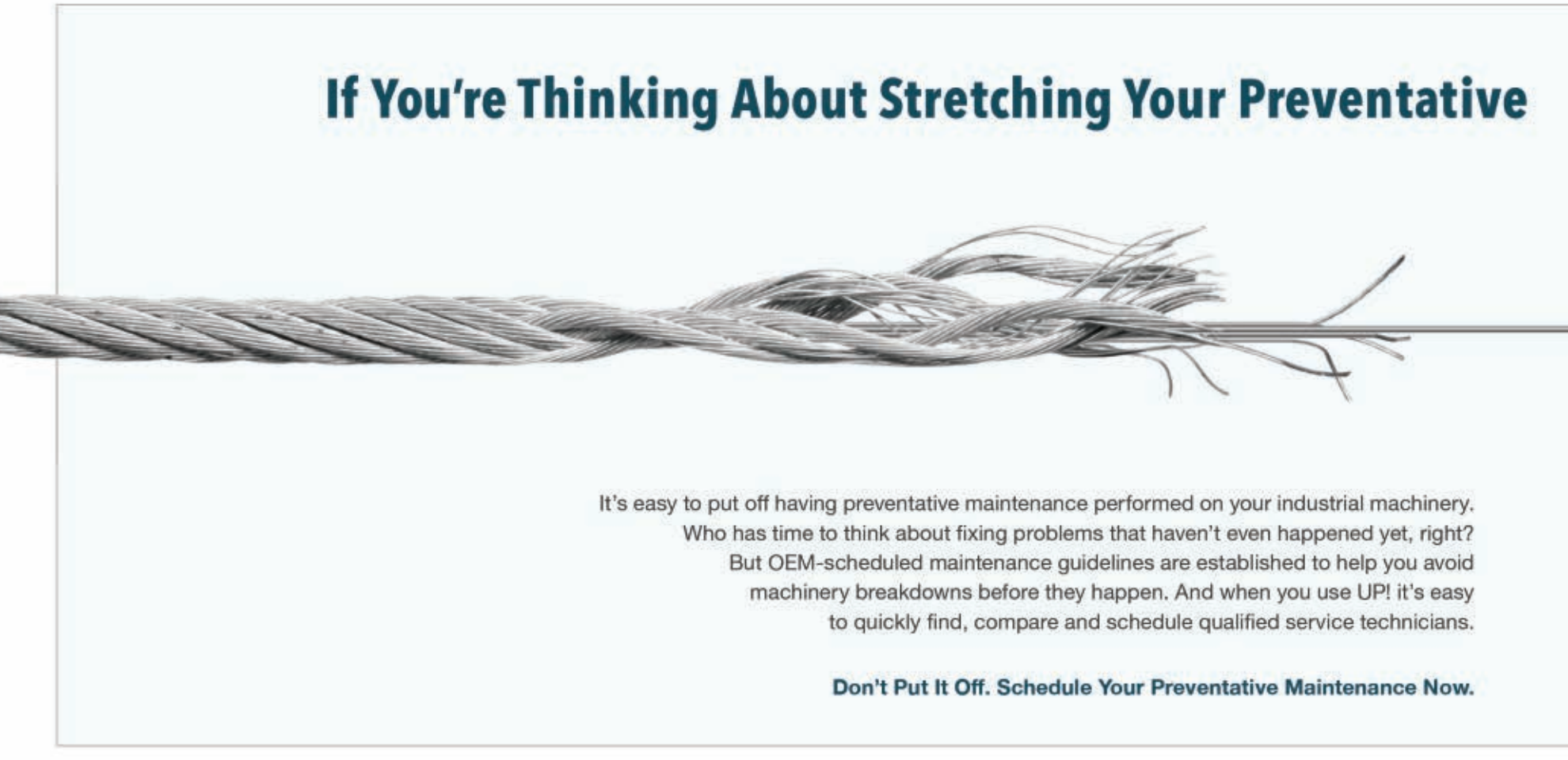
By Ed Youdell

On Feb. 18 the rover Perseverance landed on the surface of Mars in the Jezero Crater after traveling 293 million miles in just a little over 203 days. It was an unbelievable accomplishment for the NASA engineers, scientists, and technicians who worked together to both conceive and execute the mission. Surviving the "seven minutes of terror"—the point in the mission when entry, descent, and landing occur at a pace much quicker than the radio signals providing updates can reach Earth from Mars—had to be stress-filled for all of those involved, but the end result had to be worth the short-term nerves.

Perseverance is now the fifth rover to land successfully on Mars, joining Sojourner, Opportunity, Spirit, and Curiosity. Perseverance is the perfect name for this rover. Not only does it capture all of the hard work and long hours required to pull off such a mission, but the name also aptly summarizes what we've all been through over the past 12 months. Perseverance has been required as the metal fab industry's leaders and professionals have had to deal with changing work dynamics brought on by the pandemic, state-mandated shutdowns, and political discourse that has tested most everyone's patience and perseverance.

COVID-19 continues to occupy our nation's consciousness, and I find myself wondering if I were to ask 25 people to name the Mars rover, could they tell me? Have we as a nation become too distracted by the likes of Prince Harry and Meghan Markle to appreciate this incredible scientific achievement? NASA's website describes Perseverance's mission as follows: "The Mars 2020 Perseverance Rover will search for signs of ancient microbial life, which will advance NASA's quest to explore the past habitability of Mars. The rover has a drill to collect core samples of Martian rock and soil, then store them in sealed tubes for pickup by a future mission that would ferry them back to Earth for detailed analysis. Perseverance will also test technologies to help pave the way for future human exploration of Mars."

The last sentence of the mission's description is incredibly bold and exciting. It's difficult for me to picture humans someday landing on Mars because I don't think that such an event will occur in my lifetime. Yet as sure as I'm sitting here in my living room writing this, I believe they will.





Considering this idea, I'm drawn back to Sept. 12, 1962, when President John F. Kennedy delivered his famous moon speech, largely written by his aide Ted Sorensen. On that day Kennedy laid down a bold vision for space exploration for his audience at Rice Stadium in Houston, declaring that by the end of the decade the U.S. would send a manned spacecraft to the moon.

As I read the speech, I found several passages that apply to current times as well. "We meet in an hour of change and challenge, in a decade of hope and fear, in an age of both knowledge and ignorance. The greater our knowledge increases, the greater our ignorance unfolds." These words bring to mind how Google, Twitter, and TikTok appropriately challenge both knowledge and ignorance.

Kennedy continued, "So it is not surprising that some would have us stay where we are a little longer to rest, to wait. But this city of Houston, this state of Texas, this country of the United States was not built by those who waited and rested and wished to look behind them. This country was conquered by those who moved forward—and so will space. But why, some say, the moon? Why choose this as our goal? And they may well ask why climb the highest mountain? Why, 35 years ago, fly the Atlantic? Why does Rice play Texas? We choose to go to the moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too."

On July 20, 1969, just short of seven years to the day Kennedy unveiled this bold pursuit to the world, Apollo 11 came to rest on the surface of the moon after traveling 240,000 miles in space. I was 6 years old when that happened, and I will never forget being in our family room in Watervliet, Mich., gathered around the black and white Zenith console television set with my parents, grandparents, sister, aunt, and uncle, watching Neil Armstrong step on the surface of the moon. The brilliance of President Kennedy's challenge is that it was an endeavor that bound our entire nation together for a common goal and purpose. As a nation, it would seem now is as good a time as any for our president to do something similar.

So, I ask you, the metal fabrication industry's job shop owners, leaders, and professionals, what is your company's moonshot? What is the goal that will serve to organize and measure the best of its energies and skills? Are you going to stay where you are a little longer to rest, to wait? Or are you ready to move forward? What challenge are you willing to accept, unwilling to postpone, and intending to win?



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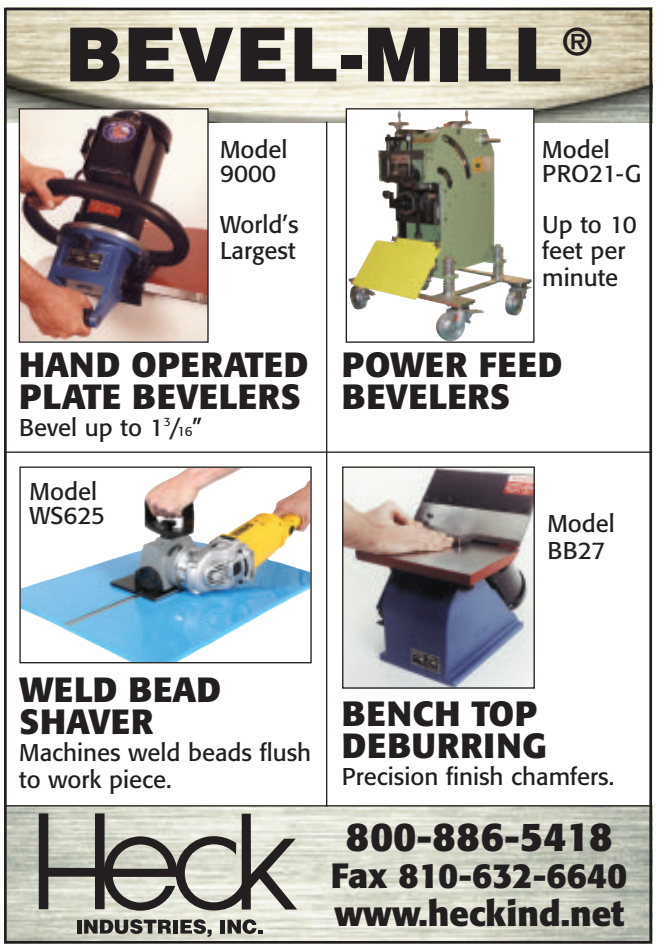
Oshkosh Defense receives USPS contract to produce new vehicle fleet

The U.S. Postal Service has awarded Oshkosh Defense, a wholly owned subsidiary of Oshkosh Corp., Oshkosh, Wis., an indefinite delivery, indefinite quantity contract to produce the Next Generation Delivery Vehicle (NGDV), the USPS's first large-scale fleet procurement in three decades. The contract allows for the delivery of 50,000 to 165,000 vehicles over 10 years.

The company will manufacture both zero-emission battery electric vehicles and fuel-efficient, low-emission internal combustion engine vehicles, upgrading the USPS fleet to be increasingly sustainable. The USPS has committed to pay Oshkosh Defense $482 million to initiate engineering efforts to finalize the production vehicle design and for tooling and factory build-out activities that are necessary before vehicle production.

Production of the vehicle is expected to begin in 2023.







Mid Atlantic Machinery establishes federal contracting division

Harrisburg, Pa.-based machine tool distributor Mid Atlantic Machinery Inc. has announced its newest division, which will serve the U.S. federal, state, and local government by providing and maintaining manufacturing equipment for transportation, shipbuilding, aerospace and aviation, defense, oil and gas, structural steel, and metal fabrication.

The company represents manufacturers of machinery for CNC precision machining, sheet metal processing, tube and pipe fabrication, metal stamping and finishing, plate and structural fabrication, metal cutting, and sawing.

Dixie Southern adds heavy-duty plate roll



Steel plate fabricator Dixie Southern has installed a new DAVI model MAV3045 plate roll at its fabrication facility in Duette, Fla., for manufacturing ASME pressure vessels, API shop fabricated tanks, rolled and welded pipes, stacks, autoclaves, bulk storage, ductwork, and process piping.

The plate roll equipment can handle different plate thicknesses, making it suitable for heavy-duty applications. It incorporates accurate plate feeding and three hydraulic motors to help ensure defect-free products and reduced downtime, the manufacturer reports.

Industrial Magnetics acquires Walker Magnetics

Industrial Magnetics Inc. has announced the acquisition of substantially all of the assets of Walker Magnetics Group Inc., a provider of custom and standard magnetic products for workholding, material handling, and separation applications in Worcester, Mass.

Industrial Magnetics is a provider of permanent and electromagnetic systems, based in Boyne City, Mich.

FMA report reveals job shop business conditions

Fabricators & Manufacturers Association Intl., Elgin, Ill., has published its "Forming & Fabricating Job Shop Consumption Report" for Q4 2020. This biannual report compiles data from small to midsized job shops to provide an accurate and instructive assessment of what is happening in the heart of the U.S. manufacturing sector.

The latest report covering Q4 2020 offers commentary from FMA's economic analyst Dr. Chris Kuehl before digging into respondent data. Dr. Kuehl highlights the trends of consumer consumption occurring throughout this unusual recession, the state of manufacturing, and respondents' levels of cautiousness for the upcoming year.

COVID-19 lockdowns and safety measures have cut consumers off from the service sector—everything from restaurants to concerts and events and travel—that once accounted for more than 65% of their disposable income. As a result, there has been less damage inflicted on the overall manufacturing sector than would have been expected in a recession this deep.

Employment has been the key issue for the economy throughout the crisis. At one point, there were 50 million people thrown out of work in a single month. But like everything else with this recession, the impact has been unusual, with many of these job losses in the service sector.

For manufacturers and fabricators, the labor issue is still one of shortage. There simply are not enough qualified people. Only 20.2% of respondents reported adding people to the payroll, while 57.5% reported stability in their workforce. Another 22.2% indicated they were reducing the size of their workforce.

Anecdotal evidence suggests that most of these job losses were due to employers adding machines and robots to do the jobs that people once did.

For more information, visit www.fmamfg.org/campaign/job-consumption-report.

Bystronic, MSS Nitrogen establish strategic partnership

Bystronic Inc. and MSS Nitrogen Inc. have entered into a partnership agreement to supply two systems—NitroCube - Bystronic N2 Generation powered by MSS and NitrO2 Mixing -Bystronic NitrO2 Mixing powered by MSS—into the North American market.

MSS, located in Rockhill, S.C., will supply the systems and provide installation, training, and service.

Bystronic will be responsible for the sales and distribution of these products.

NitroCube is a compact nitrogen generator suitable for use with fiber laser cutting. NitrO2 Mixing offers inline mixing of nitrogen and oxygen gas sources to create a custom mixture that helps increase laser cutting speeds by up to three times compared to N2 or O2 single supplies, according to the company.



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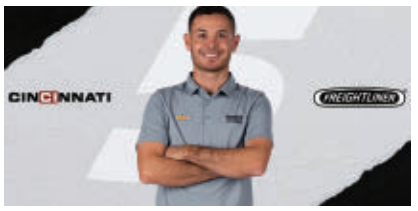
Supplier News

ABB has introduced a new series of podcasts that explore robots and automation, from collaborative robots working alongside humans in laboratories to industrial robots working in large factories producing the next generation of electric vehicles.

Each episode of the Robot Podcast features a panel of experts and takes an in-depth look at global case studies. Five episodes are being released initially, one per Wednesday, with more to follow later in the year, on such topics as cobots, health care, food, electric vehicles, and sustainability.

Aims Metrology, a Dayton, Ohio-based CMM manufacturer, has acquired the assets of Measurement Specialties Inc., also based in Dayton. MSI provides calibration, certification, and programming of CMMs, along with retrofitting and repair services.

Aims plans to cross-train its service engineers to enhance support capabilities. The OEM also will be able to increase its capabilities for the development and application of custom part programs.



Metal fabrication equipment-maker **Cincinnati Inc.**, a Hendrick Motorsports partner, has joined the organization's No. 5 NASCAR Cup Series team with driver Kyle Larson beginning in 2021. The manufacturer will be a primary sponsor of the No. 5 Chevrolet Camaro ZL1 1LE for two races.

Cincinnati, which joined Hendrick Motorsports in 2019, is its official metal fabrication and additive equipment provider.

FARO Technologies Inc., a Lake Mary, Fla.-based provider of 3D measurement, imaging, and realization technology, has announced two new strategic goals in support of its environmental, social, and corporate governance (ESG) efforts.

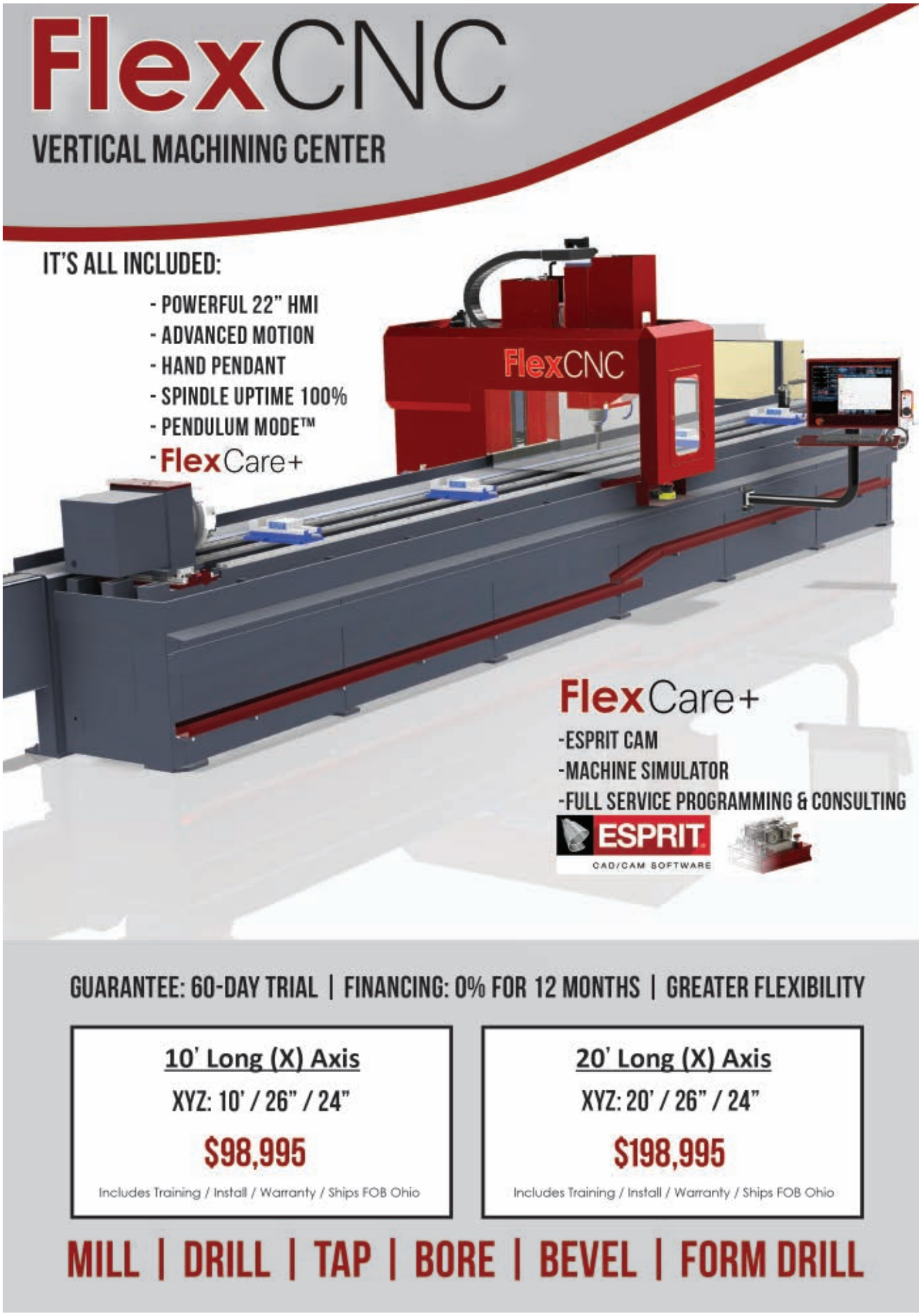
The first goal is to reduce the company's carbon emissions 25% by 2025 through aggressive activities that improve environmental performance. The second is to establish middle and high school partnerships to improve STEM (science, technology, engineering, and mathematics) curriculum, especially for minorities and females from low-income and disadvantaged areas. Year-one STEM funding will be $50,000 across the U.S., Canada, Germany, Portugal, the U.K., Singapore, and India.

The company also ensures that supply chain partners adhere to these ESG principles and practices, including the sourcing of raw materials.



Global Shop Solutions, a developer of ERP software based in The Woodlands, Texas, is celebrating its 45th anniversary this year.

Founded in 1976 by Dick Alexander, the family-owned business has grown from a small software developer to a global enterprise with five separate divisions in the U.S., Mexico, U.K., Southeast Asia, and New Zealand.





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Alro Steel opens expanded warehouse in Ohio

Alro Steel has announced the completion of a warehouse expansion and office remodel in Toledo, Ohio. With its new size of 123,000 sq. ft., the building now has additional metal processing capabilities and doubled storage capacity for sheet product inventory, plate, and long products.

The company is a distributor of cut-to-size metals and industrial supplies with more than 70 locations in 12 states.

Northeast Machinery Sales expands Massachusetts showroom

Machine tool and fabrication equipment distributor Northeast Machinery Sales has announced the expansion of its showroom in Agawam, Mass. The building now has 7,400 sq. ft. for events, seminars, and educational opportunities. The expansion includes designated space for machinery demonstrations and a total building LED lighting upgrade.

"We are excited with the expanded showroom to be able to bring in more machinery. This gives us more opportunities to demonstrate new technology available in fabricating machinery," said Vice President Steve Tapply. "Many times, a customer will come to see a specific machine, and when they see all we have to offer, they want a demonstration on everything."

Currently in its showroom, the company has band saws, ironworkers, finishing machines, plasma machines, inspection machines, and tube and pipe bending machines. It will be adding a Flow waterjet, Haco press brake, and shear in the coming months.

Ataco Steel Products to add fiber laser

Ataco Steel Products, a sheet metal fabricator in Cedarburg, Wis., has announced it will take delivery of a TRUMPF TruLaser 5030 fiber laser system in March. The 12-kW, solid-state machine offers high processing speed and reproducible part quality, even on complex contours.

The system can cut mild steel up to 30 mm thick and standard sheet sizes of 3,000 by 1,500 mm with a maximum weight of 1,800 kg for one pallet. Features include dynamic drives, high axis speeds, and a high degree of automation.

Ferrous85″ Co. to provide on-site toll slitting at SDI Sinton campus

Ferrous85″ Co., Wilder, Ky., has announced it will install and operate the largest slitting line in North America at SDI Sinton's EAF steel mill in Sinton, Texas. The line, which will be operational by September 2021, will offer toll slitting of hot-rolled and hot-rolled pickled-and-oiled material.

The slitter will process master coil widths from 36 to 85 in. and weights to 105,000 lbs. Slit width capacity is 6 to 85 in. in gauges from 0.090 to 0.750 in.

Gasbarre Thermal Processing Systems opens technical center in Michigan

Gasbarre Thermal Processing Systems has announced the opening of a 7,700-sq.-ft. technical center in Livonia, Mich., that houses sales, engineering, and service personnel.

The company is installing atmosphere and vacuum processing equipment in the technical center to support product development, customer trials, and demonstrations.

QuaLex Mfg. to expand operations in South Carolina

Sheet metal product manufacturer and distributor QuaLex Mfg. LLC has announced plans to expand operations in Ridgeway, S.C. The $2 million expansion will increase the company's sheet metal operations for air conditioning clients and create 60 jobs.

The project is scheduled for completion in August.

Can-Eng Furnaces names Production Technologies as sales rep

Can-Eng Furnaces Intl., a designer and manufacturer of thermal processing equipment for ferrous and nonferrous metals, has appointed Production Technologies Intl. LLC (PTI) as sales representative for Michigan, Ohio, Indiana, Iowa, Wisconsin, Kentucky, and western Pennsylvania.

PTI is a full-service manufacturer's representative agency offering ovens, furnaces, metal finishing systems, industrial controls, automation, fixturing and material handling equipment, dispensing systems, and turnkey retrofit and installations.

Square Deal Machining acquires Kurtz Truck Equipment

Square Deal Machining Inc. (SDMI), a provider of machining, fabrication, welding, and assembly services in Marathon, N.Y., is expanding its business operations with the acquisition of local truck equipment and fabrication company Kurtz Truck Equipment.

Kurtz, a fabricator of propane trucks, crane trucks, and dump bodies, will maintain its current business structure, and all employees will operate separately from SDMI.



Eriez completes plant expansion in Pennsylvania



Erie, Pa.-based separation technology provider Eriez has completed a 38,000-sq.-ft. expansion to its Wager Road facility in Erie, Pa., about 15 miles from company headquarters.

This manufacturing bay addition brings the facility to 148,000 sq. ft. and supports the manufacturer's growth initiatives for global R&D, aftermarket repair and testing, and recycling equipment technology.

Survey details "new normal" for small, medium-sized manufacturers amid pandemic

The Manufacturing Institute's Center for Manufacturing Research and CPA and advisory firm BKD have released the results from their first survey of small and medium-sized manufacturers. Manufacturing leaders were asked to describe the "new normal" for operations in the wake of the pandemic.

Key survey findings include:

- More than 77% expect to continue struggling to identify talent in 2021 and beyond.
- Nearly 64% have re-evaluated what work can be done remotely where possible.
- More than 83% have enhanced workplace safety measures and requirements.

"The survey … reveals the diverse ways that small and medium-sized manufacturers have adapted to the pandemic—and what they expect in the coming months," said Center for Manufacturing Research Director and National Association of Manufacturers Chief Economist Chad Moutray. "It captures manufacturers, in their own words, describing the future of everything from virtual work and flexible schedules to new product lines and price pressures."

Hall Industries to open facility in Pennsylvania

Hall Industries, a family-owned engineering and manufacturing company serving the aviation industry, will open a new facility in Grove City, Pa. The company plans to acquire and renovate a 468,000-sq.-ft. brownfield site, purchase new machinery and equipment, and provide employee training.

The $11.8 million project will create 57 jobs over the next three years. While certain operations will be streamlined to the new facility, the company's existing Pennsylvania facilities will remain open.

Xometry launches Xometry Pay invoicing platform

Rockville, Md.-based Xometry, a marketplace for on-demand custom manufacturing, has released Xometry Pay, a line of payment products that allows machine shops and custom manufacturers to accept credit cards and offer payment terms for their customers. This product now is available to manufacturers currently in Xometry's network, as well as the broader manufacturing community.

S&B Modular Operations changes name to S&B Fabrication Services



Baytown, Texas-based S&B Modular Operations has announced its name change to S&B Fabrication Services Ltd. The change reflects continued growth of the company's services and products for the engineering and construction, oil and gas, renewables, and power sectors.

The manufacturer offers modular assembly, pipe fabrication, pipe supports, plate shoes, lifting lugs, and other steel plate products. Its facility houses a 50,000-sq.-ft. pipe fabrication shop with a capacity of up to 2,000 pipe spools per month, 27,000 sq. ft. of modular fabrication space, and 40 acres of modular assembly space.

Equipment includes X-ray bays that use computed radiography technology, nuclear analyzers for positive material identification, a robotic welding system, a plasma cutting system for pipe, and a 100-ton mobile gantry crane for lifting modules and heavy equipment. The company also uses SpoolGen software for spool extraction directly from clients' isometric drawings via PCF or IDF files.



People News



Hoffman Estates, Ill.-based **Bystronic**, a manufacturer of applications-oriented systems for laser cutting, bending and automation, has appointed **Gary Stevenson** as East Coast regional manager.

He has more than 28 years of experience in the metal fabrication machine tool industry, specializing in CNC lasers, press brakes, automation, and software.



Cincinnati-based **Cambrio**, a provider of manufacturing software and the corporate umbrella company for Cimatron, GibbsCAM, and SigmaTEK, has appointed **Nick Spurrett** as vice president of GibbsCAM.

He has more than 25 years of manufacturing software and CAD/CAM experience, serving most recently as regional director Americas for Hexagon Production Software. He also has experience developing sales channels throughout Europe and Asia for a number of CAD/CAM product lines.



Mason, Ohio-based **Harris Products Group** has announced that **Doug Perry**, longtime technical adviser to customers, distributors, and the Harris sales team, died Dec. 31 in Flowery Branch, Ga.

For more than three decades, Perry was instrumental in developing and patenting several gas technologies that positively impacted welding and brazing operations. Throughout his career, he traveled across the country helping companies with technical issues related to gas apparatus and systems. He was a prolific writer of articles for industry publications and was called upon regularly to be a subject expert by industry organizations and in legal cases.



InfoSight Corp., a manufacturer of metal bar coding tag systems, has announced the expansion of its sales team.

Eric LaChapelle, named regional technical sales specialist, will serve the industries of the upper northeastern U.S.

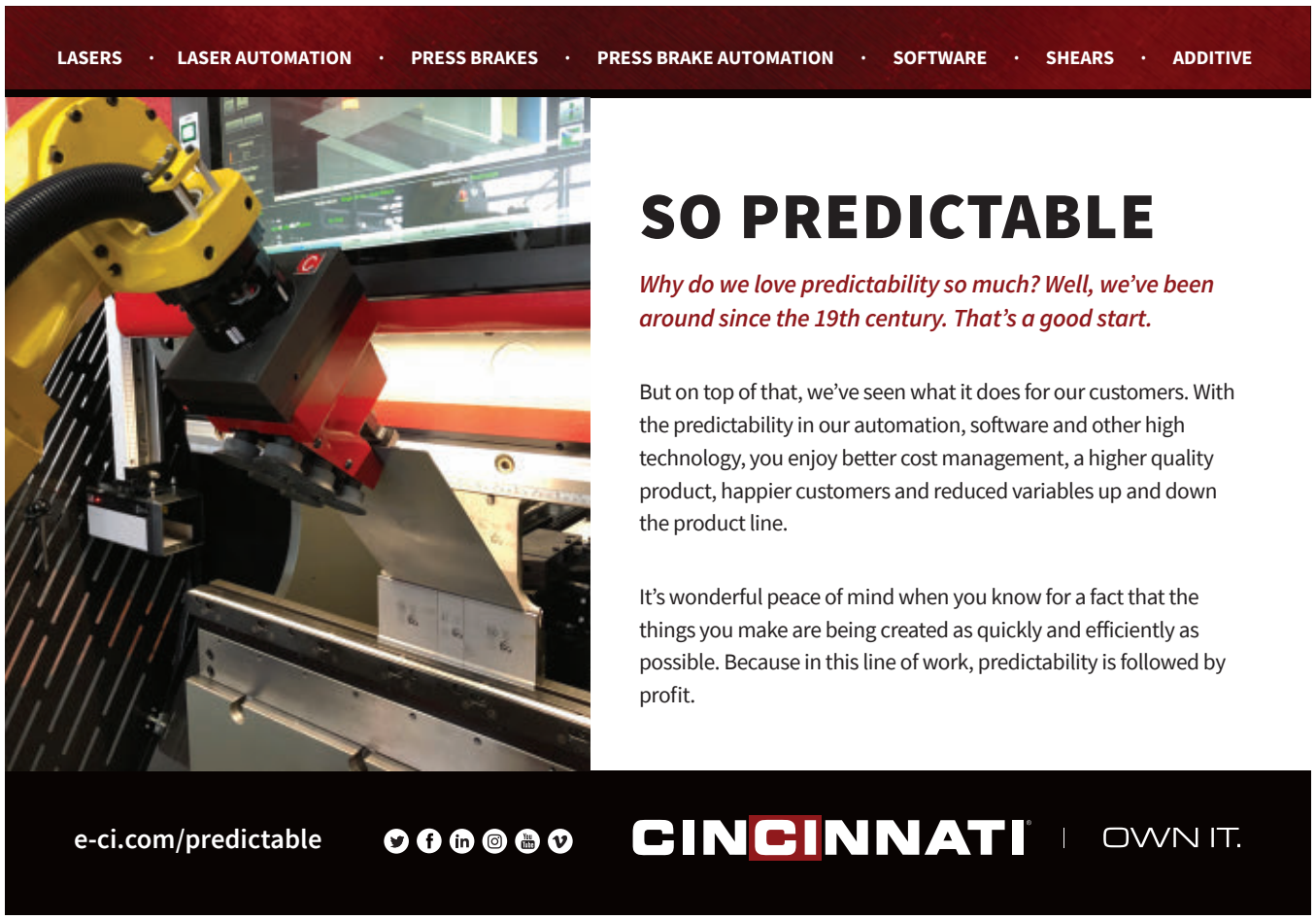
Specialty metal manufacturer **Momentum Manufacturing Group**, based in Georgetown, Mass., has promoted **Steven Gore** to COO. He joined the company in 2019 as senior vice president running the group's southern operations and spearheading marketing and business development across the organization.

Gore has more than 20 years of executive leadership experience in operations and business development for companies like Gerber Technology, Misomex Intl., and Rand Whitney Packaging.



Denmark-based **Teradyne Inc**. has appointed **Kim Povlsen** as president of cobot developer Universal Robots. He has held various executive business and technology leadership roles at Schneider Electric, and





served most recently as vice president, strategy and technology, with a global organization.

Povlsen holds a master's degree in computer science and embedded engineering from the University of Southern Denmark.



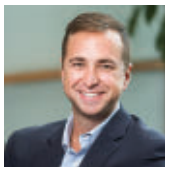
Farmington, Conn.-based fabricating machine manufacturer **TRUMPF Inc.** has hired **Eliana Fu** as industry manager, aerospace and medical, in the laser division. She holds a master's degree and PhD in materials science and engineering from Imperial College, University of London. Fu previously spent eight years as R&D services engineer at TIMET and also has worked for Firth Rixson, TWI Ltd (UK), SpaceX, and Relativity Space.

The company also has named **Brett Thompson** as TruLaser technology and sales consultancy manager for the TruLaser product group. He has held various positions during his 16 years with the company, including applications engineer for TruBend products. In his most recent role, he worked as TruLaser sales engineer.

The UP! Network, a Cincinnati-based communication platform connecting industrial service providers to service requesters, has promoted **David Rhodes** to general manager and **Sam Wright** to director of business development.

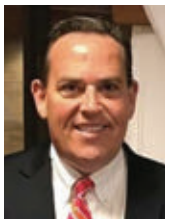


Rhodes was the company's first hire when it started in 2017. In his new role, he continues to lead the company's strategic initiatives as it expands into new manufacturing sectors and geographies. His previous experience includes Dodge Data & Analytics, LexisNexis, and Ameritech.



Wright joined the company in 2017 as business development manager. In his new role, he's responsible for the development of new market sectors and network partners. He previously worked for Trivantis and Total Quality Logistics.

Wildeck Inc., Waukesha, Wis., a manufacturer of structural steel mezzanine platforms, lifts, and safety guarding products, has named **Michael Troka** as vice president of marketing.



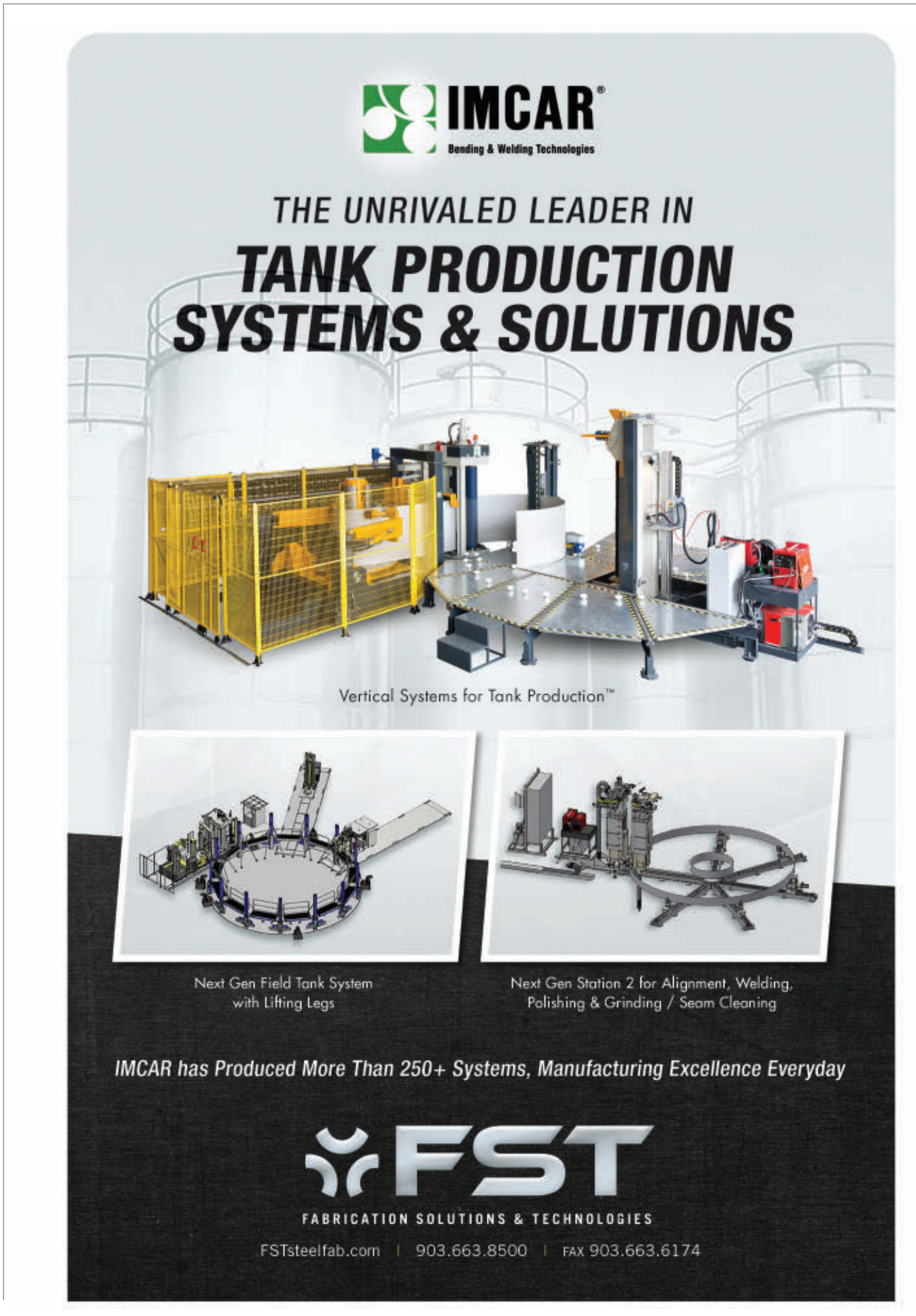
He has 20 years of experience in corporate marketing and advertising agency account management roles for Fortune 500 companies. He holds a bachelor's degree in biology and a master's degree in communications/advertising from Marquette University.

Website News

The **Manufacturing Cleaning Association (MCA)** has developed a new website at **manufacturingcleaning.org** to provide members and industry visitors with information about manufacturing and industrial cleaning, as well as its importance and benefits.

The site offers articles, white papers, and other resources from association members and experts. It also provides

(continued on page 24)



(continued from page 23)

information about the association, its members, and member benefits; updated cleaning standards; industry resources; and industry-related events.

A new website at **www.tabindustries.com** from metalworking manufacturer **TAB Industries LLC**, Reading, Pa., showcases the company's laser cutting, metal fabricating, welding, powder coating, design engineering, and other in-house services.

Featuring live-action videos and in-depth information, the website highlights the company's packaging, assembly, fulfillment, supply chain, and other critical support services and presents customer case studies.

Essex Industries acquires Stevens Mfg.

Essex Industries, a supplier to the aerospace and defense market, has acquired Milford, Conn.-based Stevens Mfg., a provider of precision-machined OEM parts and subassemblies to the rotorcraft market.

Essex Industries operates from facilities in St. Louis, Mo., and Huntington Beach, Calif., producing platform controls, aircraft components, and emergency breathing and liquid oxygen equipment. The acquisition supports its business strategy of further expanding its aerospace and defense product portfolio and allows for improved service for customers in the Northeast.

Stevens Mfg. continues to operate with the same name and location.

Allied Machine launches Allied Tool Academy

Allied Machine & Engineering, a manufacturer of holemaking and finishing cutting tools based in Dover, Ohio, has launched the Allied Tool Academy online training program.

Currently open for registration at www.alliedtoolacademy.com/learn, the platform provides the same tooling training included in the company's three-day, in-person training at its facilities for distributors and end users. Known as TES Online Certification, the 10 courses currently available contain product overviews, demos, and short quizzes.

As the online platform grows, additional content will be added such as specific product applications, online tools, distributor utilities, and live educational broadcasts streamed from Allied's training facility.

Women in Manufacturing Education Foundation announces 2021 board of directors

The Women in Manufacturing Education Foundation (WiMEF), Cleveland, has announced the election of 20 members to its 2021 board of directors. Terms began April 1.

The board is led by Chair Mary Ellen Grom, executive director of customer experience solutions with AFL in Duncan, S.C., and Vice Chair Steve Speich, factory manager with John Deere Intelligent Solutions Group in Fargo, N.D.

First-term members of the 2021 WiMEF board are:

• Michel Conklin, executive director, BotsIQ, Pittsburgh.

• Sascha Harrell, director of education and workforce, Purdue University, West Lafayette, Ind.



• Ivory Harris, vice president people services, BASF Corp., Florham Park, N.J.

• Danielle Lancianese, director—tile and stone category, Shaw Industries Group Inc., Dalton, Ga.

• Leslie LeMair, vice president of sales and marketing, George Utz, Minneapolis.

• Jenn Martin, engineering manager, Toyota Motor Engineering and Manufacturing North America, Georgetown, Ky.

• JoAnn Mitchell, partner marketing specialist, Sandvik Coromant, Fair Lawn, N.J.

• Melissa Rocha, director of strategic sourcing, Wastequip LLC, Charlotte, N.C.

• Catherine Ross, director of education, Smartforce development, AMT—The Association for Manufacturing Technology, McLean, Va.

• Shauna Smith, director of process improvement, Americas, SPX Flow, Charlotte, N.C.

• Laura Wilde, senior director quality and mission assurance, Aerojet Rocketdyne, Huntsville, Ala.

"On behalf of the entire WiM organization, I am thrilled to welcome this new group of leaders to the WiMEF board of directors," said WiM President Allison Grealis. "The work of the WiMEF—to provide effective and affordable manufacturing industry skills and leadership programming—is extremely important in furthering the advancement of women in the industry."

WiMEF funds the Leadership Institute for Women in Manufacturing and STEM, the Leadership Consortium, the Management Development Program, and the Empowering Women in Production Program. In addition, the foundation, with direct support from Arconic Foundation, has delivered more than 40 virtual learning sessions since its inception in 2016. These programs have helped more than 12,000 women and men in the industry grow professionally and personally.

Additional members of the WiMEF board who are continuing their service are:

• Rachel Camarillo, CFO, Erin Air, Seattle.

• Alicia Cannon, CEO, Apex Filling Systems, Michigan City, Ind.

• Cara Herzog, director of workforce development and diversity and inclusion, Southwire Co., Carrollton, Ga.

• Kaitlyn Pogue Kelly, operational excellence coach for digital and energy services, Trane Technologies, Lexington, Ky.

• Sheila LaMothe, vice president of strategic initiatives, Goyer Management Intl., Lakewood Ranch, Fla.

• Susanne Lauda, director of global advanced manufacturing technology, AGCO Corp., Duluth, Ga.

• Gretchen Zierick, president, Zierick Manufacturing Corp., Mount Kisco, N.Y.

Grealis also thanked outgoing members of the WiMEF board for their outstanding service: Teresa Beach-Shelow, Superior Joining Technologies Inc.; Erika Ferrell, Hy Cite; Katie Kelley, BMO Harris Bank N.A.; Bernadette Palumbo, Sonepar; Traci Tapani, Wyoming Machine Inc.; and Kelli Wells, STEM Leadership Alliance.



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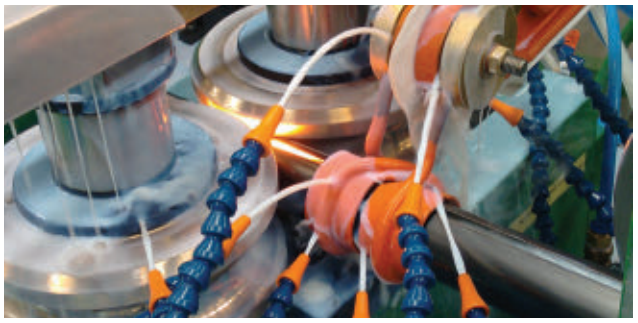
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Free Technical Solution Guide

Cooling equipment manufacturer saves time, energy costs with HF tube welder



SITUATION

A large North American manufacturer of cooling and heat transfer equipment was using an electric resistance welding (ERW) copper wheel system to produce tubular products for its equipment. And for almost eight years, the company discussed upgrading its machines to be rid of the challenges they presented.

"When we were running the ERW copper wheel system before, we had to make sure the seam was straight up, the profile was just right, and start the welder by producing scrap to allow the copper wheel to heat up before everything was ready to go," said the plant engineer.

RESOLUTION

The equipment manufacturer chose a Thermatool high-frequency (HF) welding machine with HAZControl technology and a variety of welding frequencies. It features a user-friendly operator console that stores recipes for future use.

"All we have to check before starting the high-frequency welder is that the recipe profile that we've saved in our system matches the pipe we plan to fabricate," the plant engineer explained. "Once started, the system takes over right where it left off and adjusts automatically from there."

Thermatool machines also offer stabilized output power from 50 to 2,000 kW. Since operators can maintain a stable welding frequency and stable power output, even at low power levels, every tube from start-up to full speed to shutdown has the same weld quality, and scrap is minimized.

As a result, energy usage at the cooling equipment manufacturer has improved.

"We knew going to an HF welder would consume less power than the copper wheel, so we installed a power data logger on both machines to see exactly how much power we saved," said the plant engineer. "With our Thermatool machine, we're utilizing 54% less energy compared to the weld wheel system we used to have. In addition, we're not consuming any power at all on standby mode. Plus, we've seen our run time percentage reduced by 50.1%, while our mill speed increased by exactly 25%. It's miles ahead of what we've had in the past.

"When we finally upgraded, it was one of the best decisions this company has made. The power and scrap savings alone are worth it, never mind the quality and the control," said the plant engineer. "It's a huge step in the right direction."

Thermatool
www.thermatool.com



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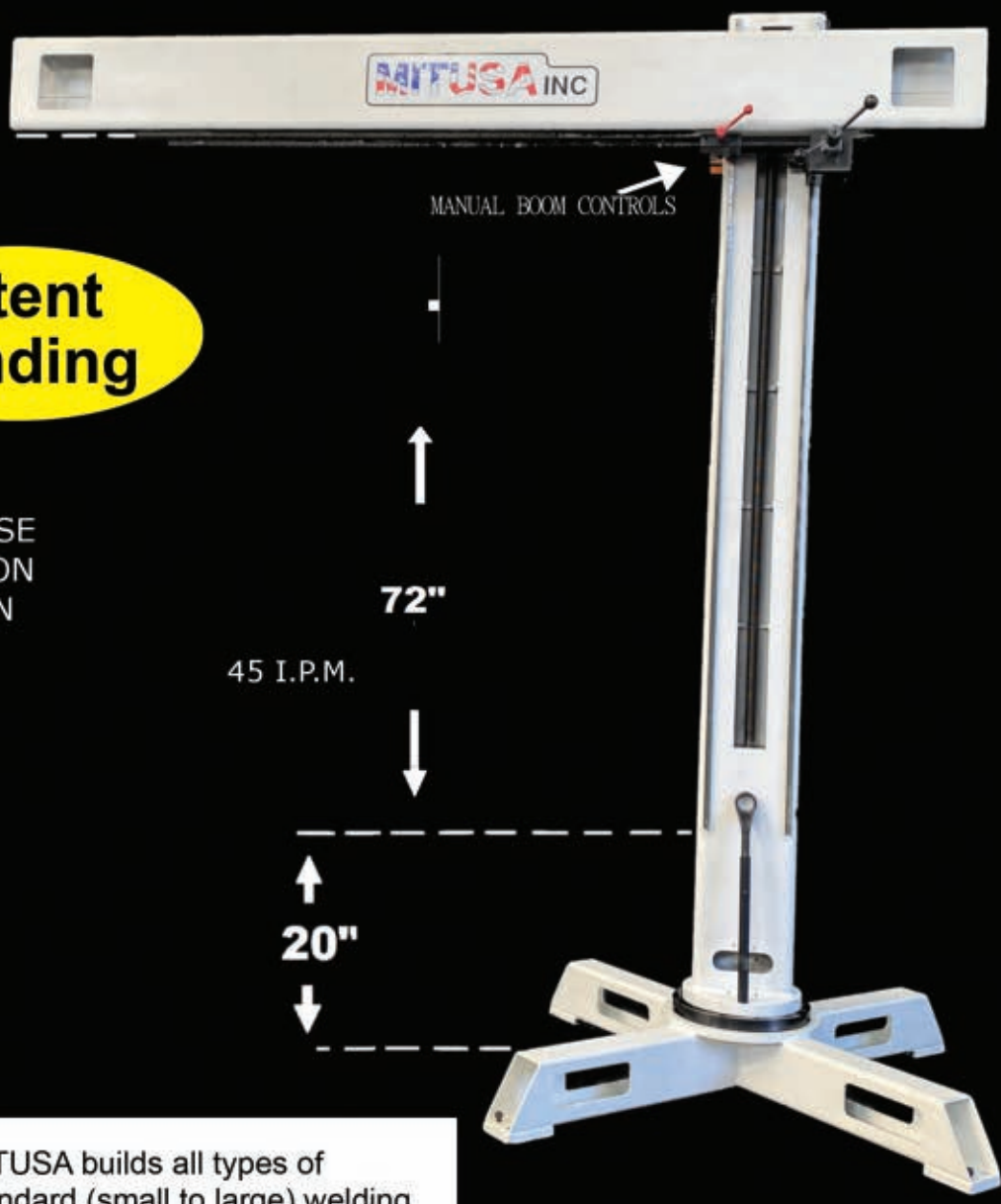
The MITUSA welding manipulator product line is perfect for welding pipe, tanks or vessels and provides up to 500 lbs of welding equipment mounted on a linear rail column. The MITUSA manipulator arrives ready to set up IN MINUTES, with all the tooling provided for EASY SET UP. The Rigid Clamping system allows for STABLE WELD OSCILLATION. The MITUSA precision welding manipulator design offers a wide variety of ergonomic features:

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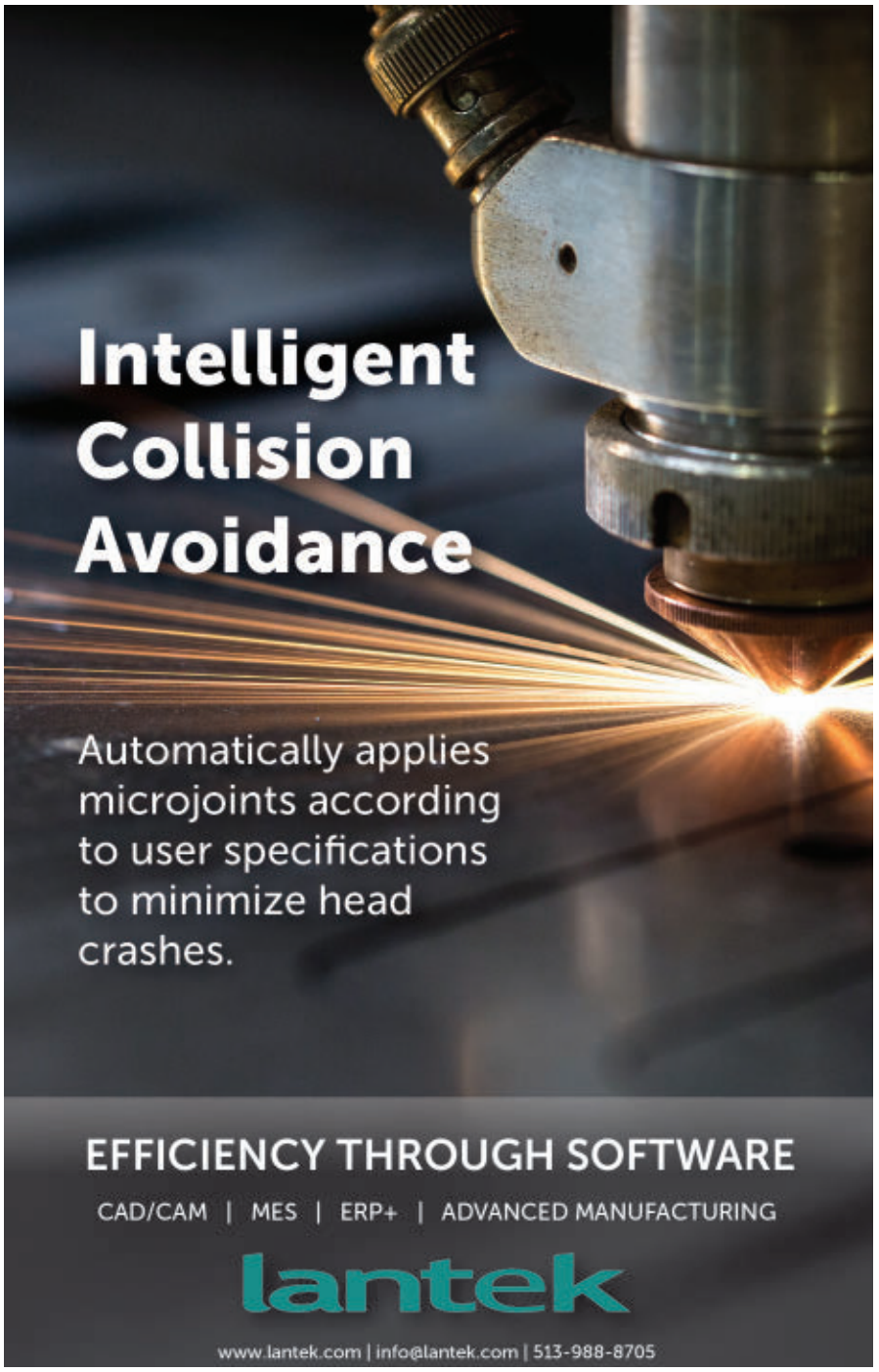
Exact Metrology offers Raytech shop floor dimensional measuring systems for measuring parts for cutting, bending, punching, waterjet cutting, laser cutting, drilling, and tapping.

The single-axis table is suitable for checking flat sheets with straight edges and square corners. It helps reduce setup time, scrap rates, and part backlog, says the company. The table integrates with SPC software for quality tracking and reporting and reduces operator-to-operator variation. The squareness gauge allows users to check sheets for edge perpendicularity or camber, while diagonal blocks allow the user to check corner-to-corner squareness on sheets.

The 3-axis table is suitable for checking laser- and waterjet-cut sheet metal parts with many features that are bent and formed. It includes flexible metrology software, sealed Heidenhain encoders, low-maintenance linear bearings, and a Renishaw touch probe. The table can integrate with SPC software for quality tracking and reporting.

Exact Metrology Inc.
www.exactmetrology.com







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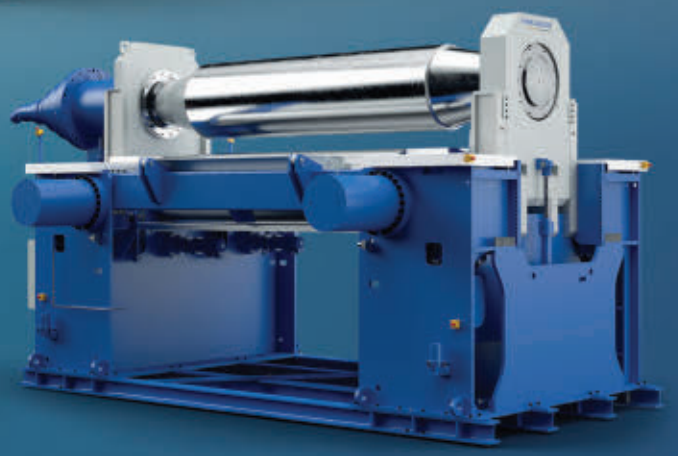


LSAW Pipe Roll Bending Machine





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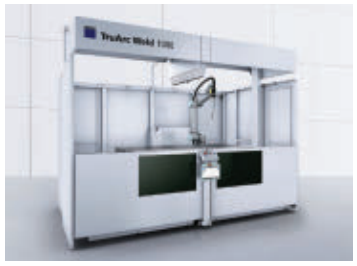
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Arc welding system features cobot-assisted programming



TRUMPF has released its first automated arc welding system, the TruArc Weld 1000. It comes with a collaborative robot that assists in the creation of the program, rather than relying on values from an offline source or an operator entering positioning data into a control.

After the operator manually guides the cobot over a part, it automatically creates the weld program. This enables fabricators to use robotic welding, even with a lot size of one.

Equipped with an operating unit, the cobot allows users to store the weld path's start, end, and intermediate points to create the program. Furthermore, the cobot control system includes templates for welding programs and parameters that cover scenarios such as different sheet thicknesses. Inside the welding system is a partition that can be moved up and down. This allows users to divide up the working area and choose between welding one large part or several smaller ones. In single-station operation, the cobot can weld parts measuring up to 80 by 24 by 24 in. In two-station operation, it can process parts measuring up to 24 by 24 by 24 in.

TRUMPF Inc.
www.trumpf.com

Four-roll plate bender handles material up to 60 mm thick



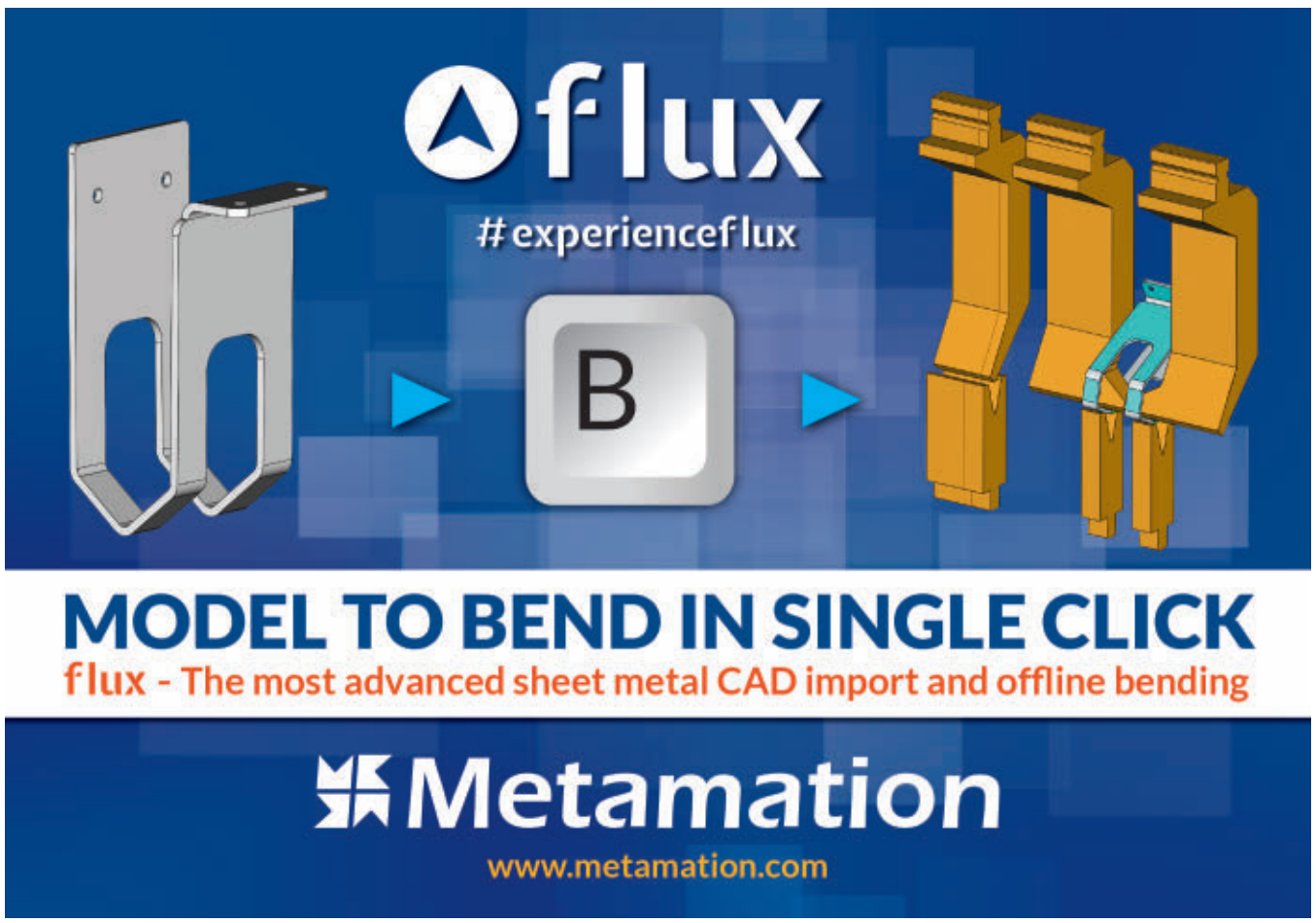
MG SRL offers the M 2060 H four-roll plate bending machine. It pinches the plate between the two central driven rolls, prebends the leading edge, and rolls the body of the part along with the trailing edge in one direction and in one pass. The plate is kept square, without slipping, during both prebending and rolling cycles because of the constant clamping of the bottom and top rolls.

With its 520-mm upper roll, the machine can bend a 60-mm-thick sheet over a working length of 2 m. Its Touch Command EVO helps the operator give the sheet the desired shape in series production, whether cylindrical, oval, squared, or with multiple diameters. Side roll parallelism is maintained by a torsion bar system that connects both ends of the roll, eliminating the weakness of extra encoders and hydraulic circuits. The two central rolls are driven by hydraulic motors and planetary gearboxes, coupled directly to the rolls.

Available with this machine is the Touch Command EVO CNC. Its new closed-loop system constantly monitors the rotation and side roll positions. In addition, the material library can be adjusted to work with the material being received. After the operator makes test bends and inputs the diameters achieved, the computer understands that material's springback and can automatically generate programs for nearly any shape required.

MG SRL
mgsrl.com





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Automation system helps maximize cutting safety

ESAB Welding & Cutting Products offers AutoRex, a fully enclosed thermal cutting system that works with any of its automated cutting machines. The machine is combined with a shuttle table for automated loading/unloading and surrounded by an enclosure that blocks UV light emissions and reduces noise. The ventilation system captures all cutting smoke inside the cabin.

The shuttle table system features dual pallets. When one plate comes out for part and skeleton removal, the new plate is ready for exchange and immediate cutting. Loading/unloading outside the enclosure isolates workers from the cutting zone and enables the use of a crane without interrupting the cutting operation. The self-cleaning system moves all slag outside the enclosure and into a bin.

ESAB Welding & Cutting Products
www.esab.com

Shotblaster handles 3,000-lb. loads

Viking Blast & Wash Systems has released the 48T shotblaster with 48-in.-dia. capacity. Maximum work height is about 30 in. at the middle of the table and up to 34 in. at the edge.

The table is lined with a self-draining, ⅜-in.-thick manganese alloy plate rotating at 5 RPM with a load capacity of 3,000 lbs. Heavier weight capacities are available.

The blast cabinet is constructed of ¼-in.-thick AR 500 place steel reinforced with structural steel. It is lined with ¼-in.-thick replaceable manganese plates in direct line with the stream.

Viking Blast & Wash Systems
vikingcorporation.com

Resistance welder includes fast rise time transformer



Weld Systems Integrators Inc. has introduced the FRT-MFDC (fast rise time, mid-frequency direct current) press-type resistance welder. The machine is designed for welding applications that require short weld times and high welding current.

According to the manufacturer, the machine offers reduced life cycle cost, improved process control for welding coated parts, weld nugget management, minimized HAZ, and reduced primary power requirements.

Applications include ring projections, weld-through sealers, hot-dipped materials, galvanized steels, hot-stamped boron materials, aluminum, nut and stud welding, and HSLA steels.

Weld Systems Integrators Inc.
wsiweld.com



Fiber laser machine offers extra-large capacity



LVD has introduced Taurus FL, a new large-format, gantry-style fiber laser cutting machine engineered for extra-large sheet metal cutting capacity. The modular machine has a 39-ft.-long bed that can be expanded in increments of 6.5 ft. to a maximum length of 131 ft.

The system can process extra-large sheets or multiple sheets and handles varying batch sizes, shapes, and material types. It accommodates workpieces up to 10.8 ft. wide and 1.18 in. thick.

Large parts can be processed without repositioning, while multiple smaller workpieces can be positioned on the cutting table and processed without interruption. Parts can be cut on one section of the table while loaded/unloaded on another.

LVD
www.lvdgroup.com

Multisensor vision system offers large field of view



The L.S. Starrett Co. has added a 0.14 magnification lens to its AVR300 multisensor vision system, giving it a 2.36- by 1.90-in. field of view. This enhancement allows more of the part to be viewed in every image for improved efficiency and accuracy.

With its ability to stitch together multiple images into one larger image, as well as its touch probe technology, the AVR-FOV 0.14X can inspect a variety of features on large or complex parts, as well as on multiple small parts.

Automated part programs deliver accurate results to the micron level in seconds with go/no-go tolerance zones, says the company, and data is provided in one report.

The L.S. Starrett Co.
www.starrett.com

Glove provides dexterity, grip, cut protection



SmartCut BKCR303 gloves from Brass Knuckle combine a glass fiber and ultrahigh-molecular-weight polyethylene (UHMWPE) shell—a composite yarn that has a strength-to-weight ratio eight to 15 times greater than steel—and polyurethane coating. The 13-ga. material provides dexterity, grip, and ANSI cut level A2 protection.

The polyurethane coating on the palm and fingers offers excellent grip and enhanced puncture protection and abrasion resistance. The glove's uncoated back and wrist improves ventilation.

Brass Knuckle
www.brassknuckleprotection.com

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Estimating platform can extract and annotate PDF data for quoting

Paperless Parts has updated its quoting platform with a new feature that unlocks the PDF files commonly shared with RFQs and makes the technical data within them more accessible and actionable. This helps job shop manufacturers and fabricators turn around quotes faster and offer more accurate, consistent estimates, the company reports.

Dynamic Measurements allow quick interaction with a print to understand dimensions when users do not have a 3D model. Users can click on the print to take dimensions that are not clearly labeled but may impact fixturing or spacing, toggle between unit measurements, and annotate in comments for future reference. In addition, vectorization and analysis capabilities turn a PDF into a DXF to extract complete data.

Paperless Parts
www.paperlessparts.com



Slag cleaner cleans flatbed laser machines



Mac-Tech has introduced the Slat Boss slag cleaner, designed for use on flatbed laser machine tables. It can support slats from 0.10 to 0.157 in. thick.

With automatic forward feed, the machine cleans slag up to 1.24 in. thick off steel, stainless steel, and copper support slats. The slats do not have to be removed for cleaning.

Mac-Tech
www.mac-tech.com

Caps and plugs protect pipe ends



Protective caps and plugs from Elesa can be used to cushion pipe ends, as well as prevent loss of fluids or ingress of foreign matter.

The NCT high-grade polyethylene caps are intended to cover tube ends to prevent damage, restrain leakage, and prevent ingress of foreign material. They are available in internal diameters from 4 to 114.3 mm.

The TX series threaded plugs in red polyethylene are designed for installation by hand in production and assembly phases of pneumatic and hydraulic systems to protect against dust and humidity. They are offered in sizes from M8 to M26 (G1/8 to G3).

The TNX series in yellow polyethylene features an NBR O-ring seal for tool installation by screwdriver, spanner, or socket. Sizes are M8 to M52 (G1/8 to G2).

Elesa
www.elesa.com

Lightweight SMAW unit offers portability for job site use



Miller Electric Mfg. LLC has released the CST 282 SMAW/GTAW machine. The portable, lightweight unit can be plugged into nearly any source of primary power on the job site.

Providing 280 amps of welding power, the machine includes a digital meter that provides precise control when presetting or monitoring welding amperage. Voltage-reducing device technology helps reduce output when the operator isn't welding to help improve safety.

Miller Electric Mfg. LLC
www.millerwelds.com

Inline XRF analyzer automates material analysis



The new Vanta iX inline X-ray fluorescence (XRF) analyzer from Olympus automates material analysis and alloy ID on the manufacturing line, delivering instant results for real-time process monitoring and 100% inspection.

Designed to operate 24/7, the analyzer provides material and grade ID in seconds. It delivers pass/fail results or full material chemistry. With a silicon drift detector and the company's Axon Technology, the analyzer can test a variety of alloy and metal grades.

Olympus
www.olympus-ims.com

Drill designed for cost-effectiveness

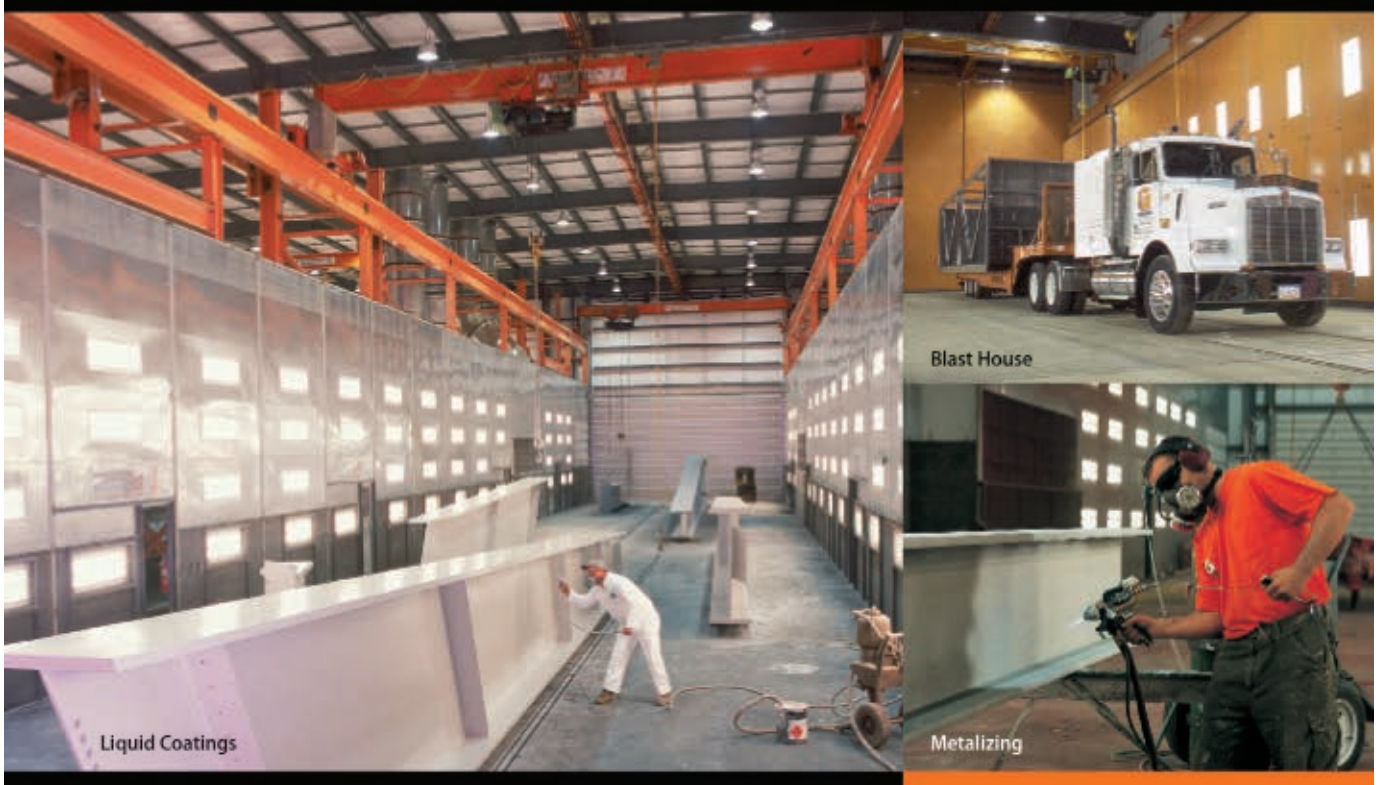


Suhner has introduced the EconoMaster customizable drill for multiple materials, including light metal. It features low power and air consumption, an adjustable motor housing, adjustable total stroke up to 4 in., hydraulic feed control cylinder, and J33 taper spindle end.

The 45-lb. drill also features adjustable feed stroke of ½ to 3 in., 400-lb. thrust at 85 PSI, operating pressures to 110 PSI, and speeds to 9,600 RPM. It can be supplied with an adjustable stand, inline vertical configuration, and multiple spindle heads for medium-duty production drilling.

Suhner Industrial Products Corp.
www.suhner.com

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Kits help increase cobot flexibility



ATI Industrial Automation has developed CRX-Ready End-Effector Kits for users of FANUC CRX cobots. These all-in-one packages include options for automatic tool changing, force sensing, and material removal to help simplify tasks such as assembly, machine tending, part inspection, and surface preparation.

In addition to the end effector, the kit has all the hardware and software required for system connection. Within the teach pendant are controls to program the equipment and simplify complex tasks. Through a few programming adjustments, the end effectors can be repurposed and adapted for future applications.

ATI Industrial Automation
www.ati-ia.com

Modular system available for laser welding, marking, resistance welding



Amada Weld Tech has introduced the Jupiter series of modular systems for precision joining, available for laser welding, laser marking, resistance welding, micro arc welding, and hot bar bonding applications.

The modular system comes in four sizes, so it can be adapted to specific production requirements and configured to fit all process components and modules. All models are equipped with a human-machine interface with touchscreen and standard safety features.

The control system, based on a PLC or industrial PC, collects all available process parameters and process data. The data can be stored in local and remote storage areas, all engineered to integrate with an Industry 4.0 factory concept.

Amada Weld Tech
www.amadaweldtech.eu

Two-robot system allows scanning of large parts

North Star Imaging's Dual RobotiX technology features two robot arms



working together to scan large parts. It is an add-on device for the manufacturer's X7000 system.

Using the efXDR acquisition software, the operator can program the robot and configure the image acquisition parameters. The simple interface also allows the operator to X-ray-inspect large parts using 6 degrees of motion at any given point.

North Star Imaging
4nsi.com/innovations/robotix







Diesel welder/generator delivers 400 amps



Lincoln Electric has introduced the Vantage 441X diesel engine-driven welder/generator. Equipped with a 41-HP, turbocharged Perkins diesel engine, the unit provides true IEC-rated, 400-amp, 100% duty cycle DC welding output. It delivers the power required for running heavier electrodes and arc gouge carbons, with excellent cold-weather and high-altitude operation, the company states.

The welder/generator offers SMAW capabilities and features customized weld modes for carbon steel, aluminum, and stainless steel. It also includes dedicated SAW and orbital pipe modes, along with synergic pulse capabilities for improved arc performance in GMAW.

Lincoln Electric
www.lincolnelectric.com

Combination straightener/reel designed for light-duty applications



Coe Press Equipment has introduced a coil straightener/reel combination for stampers and roll formers that process light-gauge materials to produce components such as brackets, hinges, and moldings. Combining unwinding and straightening in a single machine, the system can be paired with the manufacturer's ServoMaster 1 or 2 servo roll feed to form a complete press feeding line.

The system can process MCRS, aluminum, and stainless in thicknesses from 0.32 to 0.125 in. and widths from 3 to 12 in., depending on the material thickness. It can handle coil weights up to 4,000 lbs. and achieve line speeds up to 50 FPM.

Coe Press Equipment
www.cpec.com

ERP platform gives discrete manufacturers full cloud functionality

Aptean has released its Industrial Manufacturing ERP cloud-enabled platform for manufacturers in job shops or dynamic to-order and mixed-mode environments. The flexible, scalable software system retains a high level of security, provides data backups, and helps alleviate the additional costs of equipment and maintenance, according to the company.

New cloud features help users achieve real-time visibility and control over manufacturing and business operations systemwide. With integrated ERP and production scheduling capabilities, it delivers the actionable data and flexibility needed to help users maximize shop floor efficiency while reacting swiftly to customer demands.

Aptean
www.aptean.com



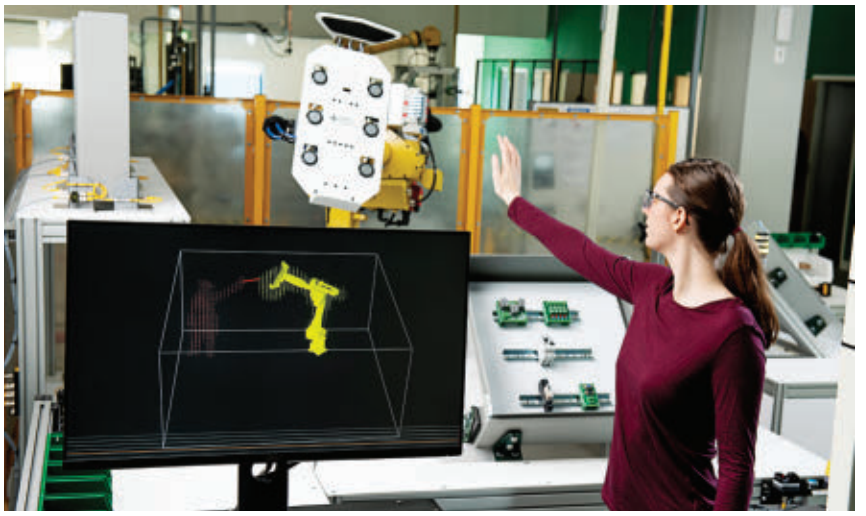


How to make every robot collaborative

Safety technology shows the potential of human-robot interaction

By Tim Heston

Visit an advanced assembly line at a major OEM and you'll likely see robots everywhere. They position, assemble, and move work down the line methodically and predictably, until a bird flies through a light curtain and the whole line stops.



FreeMove senses a potential human presence, allowing people and robots to work in the same area.

"These are some of the world's most sophisticated manufacturers, and they can't get the birds out. Nature finds a way."

So said Patrick Sobalvarro, president/CEO of Waltham, Mass.-based Veo Robotics (www.veobot.com), a company that has introduced a new way to safeguard robotics and automation in general. The idea behind Veo's technology is to enable robots and humans to work together in new ways. It essentially makes any robot a collaborative one.

When those in automation circles talk of collaborative robots, or cobots, they almost always are referring to the small power- and force-limiting robots that operators can work with and around in close proximity. Of course, power- and force-limiting robots have their drawbacks. Most designs offer only limited payload capacity, and their positioning accuracy isn't sufficient for many applications. Still, conventional robots can be extraordinarily dangerous without the proper safeguarding. Even a slow-moving robot arm can crush an appendage caught in the wrong place at the wrong time.

Recognizing the extraordinary benefit of collaborative robotics, Sobalvarro asked, could conventional robots share the safety attributes of power- and force-limiting cousins and, in doing so, become collaborative?

In 2008 Sobalvarro witnessed another technological advancement, working with a company that developed people-tracking software for the retail industry. It wasn't reliable enough at the time to be used for a safety application. But Sobalvarro realized the potential, and the idea planted the seed for Veo Robotics. Now a 5-year-old company, Veo has introduced FreeMove, an intelligent vision system that, for the right application, aims to eliminate the need for certain physical barriers, light curtains, or scanners, allowing people to work with, not away from, a conventional robot. Technology caught up with Sobalvarro's idea, and earlier this year the company announced a partnership with its first integrator, Calvary Robotics in Greenville, S.C. (www.calvaryrobotics.com).

The system has been in use at significant OEMs. Besides saving space, it has helped automate certain tasks that before just weren't practical. At one appliance-maker, for instance, a large robot presents to the operator a stainless steel refrigerator side panel, orienting it so the worker can add certain components in the right places. The act of assembling those components wasn't suitable for robotics; the variables and process complexities were just too high. But the act of presenting that large, heavy sheet metal part was ripe for material handling robotics—but only if the company found a way for the operator to work closely *and* safely with the robot itself. In this case, FreeMove filled a need.

The technology, which is compliant with ISO 13849 (safety of machinery) and other safety standards (including certification for inclusion in an ISO 15066 collaborative workcell), uses dual-channel communication among all sensors and the FreeMove engine itself.

With the potential human detected, the system assumes that human could move all or part of his or her body at 2 m per second. Using that as a foundation, the system knows where the humans are and controls the robot to accommodate, allowing for stopping distances and other safety-related parameters.



"The technology uses 3D images of the workcell and classifies objects within that workcell. And we don't use machine learning, either, because that's a probabilistic technology. Probability isn't good enough for us." Because safety is at stake, "our default is, 'stop everything,'" Sobalvarro explained. "If someone runs a forklift into the compute box, we stop everything. The absence of knowledge always means 'stop.'"

Besides the workpiece, the robot, and other known entities within the cell, the system detects any unknown object larger than 15.6 liters in volume as a "human." It also accounts for various unusual circumstances.

For instance, Sobalvarro described one robot cell with a worktable large enough for someone to hide under. In this case, if the vision system sees an object that shouldn't be there *adjacent* to the table, it assumes it could be someone's arm or head. That said, if the system were to detect an unknown object not beside but *on* that table, it will recognize it for what it is: an object, like a thermos or cup, and not a human.

Because the robot operates in an environment that could be full of humans, the stop-restart cycle is much different. Such collaborative automation wouldn't be productive if every time a human got too close, a cell shutdown required a call to maintenance personnel for a lockout/tagout procedure.

"For this reason, we automatically restart," Sobalvarro said. "If the human sees the robot stop, he takes a step back, and the robot resumes. This leads to faster *takt* times and fewer line stops."

FreeMove has yet to be applied to any arc welding or laser application, and if it were, the light from those processes—if they weren't shrouded in some way—would saturate the sensors. It wouldn't create an unsafe situation, just force everything to stop. It also is now limited to workcells up to about 64 sq. m. Sensors cannot cover massive workspaces, though such a capability might be on the horizon with what Veo calls Distributed FreeMove, where sensors placed throughout a factory could one day make safeguarding as ubiquitous as electricity or compressed air.

As of now, the system works only in specific workcells. But if such technology eventually becomes distributed, the factory of the future could look very different.

Senior Editor Tim Heston can be reached at timh@thefabricator.com.



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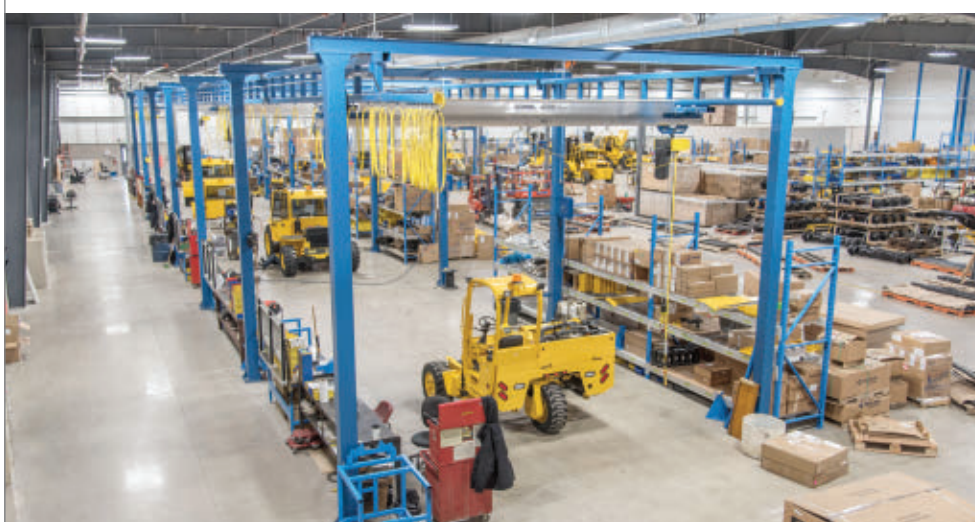
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What will the future metal fabricator look like?

Those who make best use of information will win

Read more from Tim Heston at
www.thefabricator.com/author/tim-heston

By Tim Heston

We're told Industry 4.0 is an industrial revolution as significant as the transition from cottage industries to the Henry Ford assembly line. Such transitions take years, and Industry 4.0 is no different. The puzzle pieces are starting to appear. The challenge is seeing how they all fit together.

To find out, let's try a thought experiment and imagine what a custom precision sheet metal fab shop of the future might look like. First, having excess machine capacity is conventional practice. The more excess capacity an operation has, the more demand variability it can handle, and—with so many lanes on the shop floor highway—the smoother jobs can flow from one step to the next.

An operation has just one or two extraordinarily high-powered fiber lasers, perhaps in conjunction with a punch/laser combo system (for form-tool capabilities), feeding a collection of automatic-tool-change press brakes, each of which can be robotized or operated manually depending on the job, made possible through advances in programming and safeguarding.

If something has a QR code, its usage is being tracked. For instance, tooling usage would be tracked every time a brake or punch tool is inserted and every time a machine cycles. And that tracking information is not just used to see when it's time to sharpen or buy a new tool. It is integrated with job costing data, quoting data, and general market data to guide both technology and business development.

Machines continually send data to a server, run on-site by the fabricator or off-site by the machine OEM or third party. The idea is to compare operational data with data from other machines and other shops. In this way, the machines learn and, ultimately, become more adaptable.

Lasers adapt to different surface conditions and slight thickness variations; part offloading adapts to the nest at hand, producing information the company's automated nesting engine can use. This in turn is connected directly to a customer-facing, web-based quoting engine that automates order processing.

Extending this further, data could be sent to material suppliers so they can perfect their own leveling and processing. A long and skinny part cut from a sheet full of stress can spring up and crash a head. The right leveling technology at the service center (roller, stretcher leveling, etc.) should, at least in part, mitigate the problem.

Back at the fab shop, parts flow from cutting to bending to welding to powder coating, and in each operation adaptable automation plays a prominent role. For instance, in powder coating, a robot wielding a spray gun operates with a vision system that produces a "digital twin" that gives the robot an image of the part hanging in front of it. Connected to an artificial intelligence (AI) engine, the robot instantly "learns" how to spray the workpiece for complete coverage.

Perhaps most significant might be the business relationship changes between different players in the supply chain. For instance, the "as a service" model (e.g., software as a service) might enter the machine tool world. Imagine fabricators paying not for a machine but for the *service* that machine provides—that is, the parts it produces. Such an arrangement aligns everyone toward the common goal of throughput. The more value (good parts) a machine creates, the more money both the fabricator and the machine OEM make.

The devil is in the details, of course, and the arrangement probably needs a coordinated agreement with suppliers to ensure quality raw stock. Regardless, enabling it all is continuous data-sharing between the machine-maker and its machine at the fabricator.

Still, even this level of sophistication is just a piece of the order-to-cash puzzle. Intelligent, adaptable laser cutting and bending are great, but they might not make a shop more competitive if an order takes weeks to reach the shop floor, or if parts are packaged incorrectly and damaged during shipment, or if someone insufficiently masks a hardware location or other areas of the workpiece before coating, or … well, you get the idea.

Every step of the process chain, from order to cash, can be improved with better use of information. Sometimes this entails old-fashioned worker training and clear instructions. Sometimes this involves software algorithms that help streamline or automate quoting and order processing, manage scheduling, make machines adaptable, and push overall throughput through the roof. Assemble all those puzzle pieces in the right way, and you get an incredible picture.



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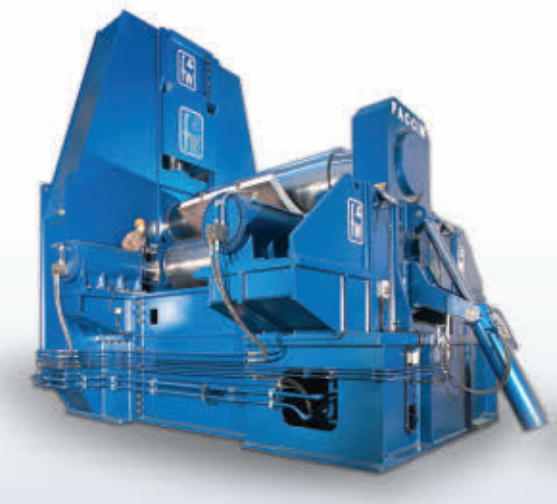
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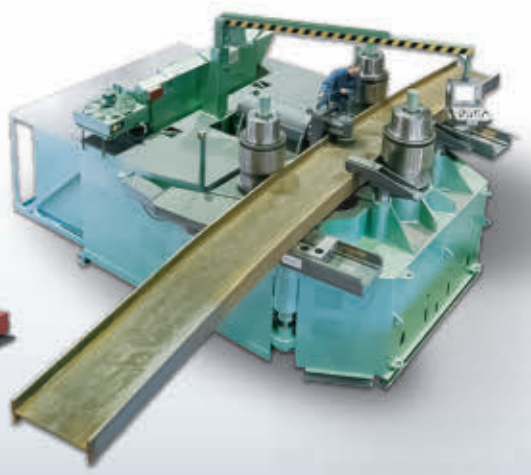
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Trump's "Buy American" rules become reality

Companies planning to sell metal products to the government pretty much have to source from domestic mills

Read more from Stephen Barlas at www.thefabricator.com/author/stephen-barlas

By Stephen Barlas

While President Joe Biden's Made in America executive order was devoid of many specifics, except for the establishment of a new vetting office in the White House, the implementation of President Donald Trump's Made in America executive order on Feb. 22 was much more significant for the metal fabrication industry.

The Department of Defense (DoD), General Services Administration, and National Aeronautics and Space Administration jointly issued final rules on Trump's EO 13881, and they will have a significant bite on U.S. metal product manufacturers selling to federal agencies where the Buy American Act (BAA) comes into play. Iron and steel products now will have to contain 95% domestic steel inputs, up from 50%.

That new 95% requirement applies to everything except for commercial-off-the-shelf (COTS) fasteners (nuts, bolts, pins, rivets, nails, and screws). The Industrial Fasteners Institute had tried to convince the Trump administration to include COTS fasteners in the 95% edict because U.S. fastener manufacturers have no trouble meeting the 95% requirement, but the government officials declined to do so, mostly because those products are so inexpensive. So no domestic content requirement will be applied to COTS fasteners sold to federal agencies.

The new BAA 95% iron and steel content requirement has been around previously but only applied to certain Federal Transit Administration and Federal Highway Administration grant programs. But for metal fabricators selling to the DoD or other federal agencies, this means that the previous 50% domestic content requirement in the BAA has just been increased 45 percentage points.

"That may not be economically feasible, and even it if is, it may not be possible before the date on which these new rules will be incorporated into solicitations and resulting contracts," explained Richard W. Arnholt, a federal procurement expert at the law firm Bass Berry & Sims.

After the proposed rule was issued by the three federal agencies in July 2019, Lori Lange, a Washington lawyer representing a fabrication company, wrote on Nov. 13: "Given the fact that our client's product lines contain highly technical, specialized components, our client anticipates that it will have difficulty locating a U.S. supplier who can comply with the proposed rule. Our client further anticipates that it may take years of reengineering, quality testing, and fabrication of tools/equipment to be able to produce Buy American compliant products under the proposed rule." When she was contacted recently, Lange declined to identify the company.

Even when a domestic company does meet the 95% mark, it can lose a sale to a non-BAA compliant customer based on price. The new Trump rule gives a boost to the "price preference," which comes into play when a product containing foreign steel is bid at a lower price than a similar product using all domestic steel.



Labor Department Cancels Trump Apprenticeship Program

The Biden administration reined in the new Industry-Recognized Apprenticeship Program (IRAP) started by the Trump administration. The program sought to give industry groups such as trade associations more of a role in creating apprenticeship programs that qualify for federal funding.

The Trump program allowed the Labor Department to recognize Standards Recognition Entities (SRE), which in turn vetted and approved IRAPs. The first pairing announced last fall was the National Institute of Metalworking Skills serving as the SRE and approving a metalworking IRAP for Raytheon Technologies. The Biden Labor Department said current SREs and IRAPs would remain operational. However, in announcing a halt in SRE/IRAP designations, Suzi LeVine, principal deputy assistant secretary for the Employment and Training Administration, seemed to indicate that the Biden administration wanted to reorient the current Department of Labor-registered apprenticeship program toward "skills in cutting-edge fields like cybersecurity, green energy, software development, and data science." She did not mention traditional manufacturing.

Employment and Training Administration, www.dol.gov/agencies/eta

Federal Highway Administration, www.fhwa.dot.gov

Federal Transit Administration, www.transit.dot.gov

Industrial Fasteners Institute, www.indfast.org

National Aeronautics and Space Administration, www.nasa.gov

U.S. Department of Defense, www.defense.gov

U.S. General Services Administration, www.gsa.gov

U.S. Department of Labor, www.dol.gov














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Kate Bachman
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What, Me Worry? Inflation and the Manufacturer

By Dr. Chris Kuehl



Suddenly this is all that anybody in the financial and business community can seem to talk about. After close to 20 years of almost no inflation threat, it now seems to be a serious concern. The fact is that core rates remain well below the target that has been set by the Federal Reserve and even further below the levels the Fed discussed at the central bank get-together in August. The threat is still a future concern.

Of the three planks that make up inflation, one is truly moribund, one is manifesting right now, and the third could be a factor later. There is no general wage inflation to worry about although the manufacturers have been seeing more costly skilled labor as it is in short supply. The commodities are where there has been significant inflation already. Metal prices are up sharply and so are commodities such as lumber. Oil has come up a bit and food will be rising sooner than later. The major reason for these hikes is simple enough — producers still do not trust future demand and have not stepped up their output. The inflation rates will calm down as the demand becomes more reliable and that happens as the lockdowns end and the economy starts to bounce back more aggressively.

AFTER CLOSE TO 20 YEARS OF ALMOST NO INFLATION THREAT, IT NOW SEEMS TO BE A SERIOUS CONCERN.

The longer-term concern is the money supply. Will nearly $2 trillion in stimulus trigger overheating as money starts to chase money? This alone is not the crucial worry. It is the possibility of a rate hike by the Fed in order to control that inflation that creates concern. At this point, the Fed has been insistent that no such hike is contemplated but a surge in prices could change their mind. The manufacturer is seeing more inflation than most other sectors — commodities and wages are up and if rates start to rise, those capital spending plans could be challenged.

Fabrinomics is the exclusive newsletter for FMA members. If you'd like more economic insights delivered straight to your email, become an FMA member at fmamfg.org/join. To ask a question of Dr. Kuehl, send it to Fabrinomics@fmanet.org.





Steel prices steaming ahead

Material availability starts to become a bigger issue

For more information, visit
www.steelmarketupdate.com

By John Packard and Tim Triplett

Signs last month that steel prices were beginning to lose steam proved premature. Price tags for flat-rolled and plate steel products have continued to move upward, setting new record highs week after week. Moving up along with steel prices are the anxiety levels of fabricators and manufacturers who must pay unprecedented prices for their raw materials.

Steel Market Update's check of the market on March 8-9 showed the benchmark price for hot-rolled steel reaching $1,270/ton ($63.50/cwt), topping the previous high mark set in 2008 by $200/ton.

"This is crazy. I'll tell you one thing, my customers can't stay in business at these price levels. We're having a hard time passing on the increases," one manufacturer in the Midwest told SMU.

"Restricted supply with the current demand makes pricing anyone's guess. There is nothing there to stop the madness, although we are reaching a critical cost/affordability point with customers. It could force some customers out of the game," commented one service center executive.

When COVID hit last spring, much of the economy shut down to stop the spread of the virus. Since then, steel-intensive U.S. manufacturing has come roaring back—though steel producers have been judicious about ramping up production once again. Today, a year after the pandemic began, steel demand continues to outpace supplies. Buyers report extreme difficulty acquiring enough steel to meet their customers' needs. Mills are scrambling to fill contract orders and have few tons available to offer spot buyers. Many service centers and OEMs have ordered foreign material—which is cheaper compared to the sky-high domestic prices—and a considerable volume of imports is due to hit U.S. shores in the next few months. Yet various mills have announced maintenance outages on furnaces and other equipment that will offset the imports to some degree and keep supplies tight, at least for the short term.

For many buyers, price is secondary to availability. "With basically no spot tons available from mills, it sounds like it's service centers selling to each other between now and May or June," commented one respondent to SMU's March questionnaire.

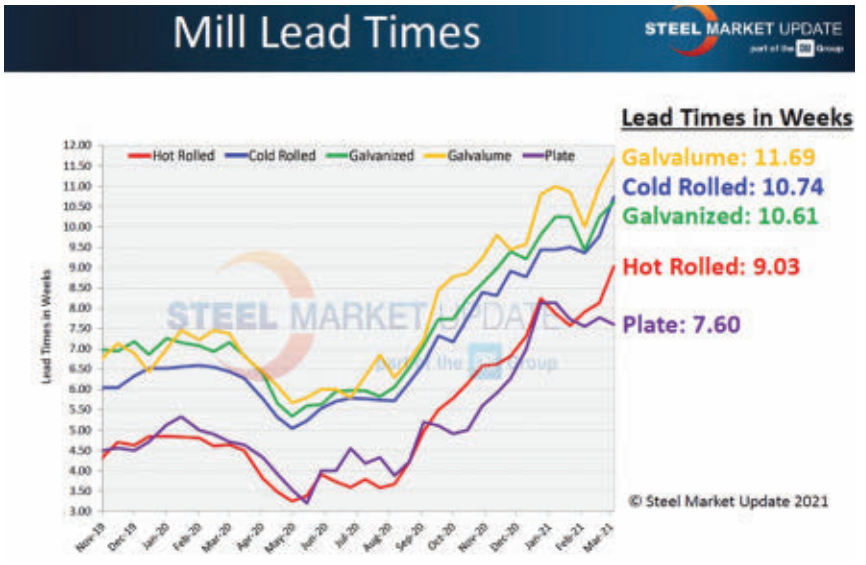


FIGURE 1
Lead times from the steel mills are increasing, and some steel buyers are reporting shipping delays. This is not a good time for metal fabricators that need steel in a hurry.

The market has actually tightened further in recent weeks, observed another service center exec: "The U. S. Steel-announced blast furnace outage and the AM/NS Calvert outage in May are examples of why it's difficult to get the capacity utilization rate much higher in this environment. With hot-rolled futures now over $1,000 through November, capitulation seems to have emerged and high prices may be here for a long time." U. S. Steel has confirmed a 25-day outage in May at one of the two blast furnaces at its Mon Valley Works in western Pennsylvania. AM/NS Calvert had not responded to a request for confirmation about an outage there before this article went to press.

To offer some historical perspective, hot-rolled has nearly tripled from a low of $440/ton ($22/cwt) in mid-August last year. The previous high recorded by SMU in July 2008, before the financial crisis, was $1,070/ton ($53.50/cwt). That's equivalent to about $1,280/ton ($64/cwt) in current dollars adjusted for inflation.

SMU pegged the average cold-rolled steel price in mid-March at $1,450/ton ($72.50/cwt), more than double the low of $635/ton ($31.75/cwt) last August. The former record high reported by SMU for cold-rolled was $1,150/ton ($57.50/cwt) in July 2008.

Like cold-rolled, galvanized steel also reached a record price early last month of $1,450/ton ($72.50/cwt). That's up from the pandemic-driven low of $630/ton ($31.50/cwt) last July and far exceeds the previous high of $1,020/ton ($51/cwt) in June 2008.

SMU's average price for steel plate in mid-March was $1,120/ton ($56.00/cwt). Plate prices dropped from around $1,000/ton ($50/cwt) in January 2019 to a low of $590/ton ($29.50/cwt) in August 2020. While it has recovered sharply like the flat-rolled products, the price of plate remains well below the price of sheet, which is highly unusual. That speaks to the sketchy health of the major plate markets (such as energy and heavy equipment) when compared the stronger flat-rolled markets (automotive and appliance).

Lead Times

One key indicator of steel demand is the lead time for spot orders from the mills (see **Figure 1**). The longer the lead time, the busier the mill. SMU data last month hinted at a possible plateauing in delivery times for orders placed with the mills. In fact, the opposite occurred, and lead times stretched out even further.

Lead time for spot orders of hot-rolled now exceeds nine weeks, while buyers of cold-rolled and coated products can expect to wait more than 10 weeks, which is double the normal wait time. Despite widespread expectations that mill lead times are overdue to reverse course as supplies catch up with demand, delivery times remain painfully long.

Buyers report that shipments from the mills are routinely late, beyond the promised delivery dates, adding to the difficulty they face in servicing their customers' needs. "Not only are lead times extended, pretty much all the mills are running tardy too," complained one service center executive, calling it "a nice little one-two punch by the mills to keep this rally alive and well."

Another buyer also was critical of suppliers: "Stated lead times are longer than normal, and then most mills are running late two to four weeks on top of that. So, we're paying outlandish prices for poor service and have seen more quality issues of late. They are relaxing their quality management parameters to get product out the door. Not a good strategy for them long term."

Of course, steel prices are a function of steel demand. SMU has been watching carefully to see if the record-high steel prices have begun to cut into order volumes. Certainly, some buyers are staying on the sidelines, postponing purchases today in anticipation of cheaper prices tomorrow. But SMU data shows little or no drop in demand in the marketplace. Given the historic stimulus package just passed by Congress, and the boost it will no doubt give the economy, it may be well into the second half, if not into next year, before steel demand and prices begin to moderate.

Asked and Answered

SMU continually surveys the market. These two questions were posed to steel buyers recently. (Each question is followed by one comment that characterized the prevailing view in March.)

At what level do you think steel prices will peak? The most common belief last month was around $1,300/ton.

"If you look back at the SMU survey from mid-December, 93% thought we'd peak below $1,000. None of us truly knows—including the glorious analysts."

When do you see prices peaking? About 60% see the peak by the end of April and 40% in May or later.

"If the steel mills have any hope of winning 'Buy American' loyalty, they should hold prices steady and restart any facility they don't have producing. Otherwise there will be tremendous manufacturing/OEM pressure on the Biden administration to repeal the Section 232 tariffs."

John Packard, president/CEO of Steel Market Update, can be reached at john@steelmarketupdate.com. Tim Triplett, executive editor for Steel Market Update, can be reached at tim@steelmarketupdate.com.







How *automation* and lean manufacturing go together

A blended approach is a must

By Paul Neblock

For years manufacturers have taken one of two paths to improve their operations. They either focus on continuous improvement and use the lean manufacturing toolbox, or invest in advanced technology to streamline operations, reduce reliance on labor, and improve core competencies. Recent world events have shown that manufacturers must find a way to blend both approaches to survive and compete.

A Changing Manufacturing Landscape

The pandemic has revealed major shifts in the strategic landscape and demographics that will forever impact how manufacturers will compete. First, human capital is fragile. COVID-19 and other diseases impact a business's ability to operate. Labor-intensive operations have a much higher risk of reduced output, constrained growth, and supply chain interruptions than those with a smaller workforce.

Second, the available labor pool is rapidly shrinking. More than 3.5 million skilled workers are leaving the workforce every year. Baby boomers are retiring and taking decades of knowledge with them.

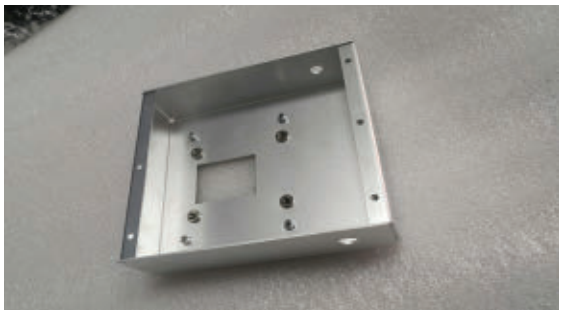


FIGURE 1
Orders for this common sheet metal enclosure can take weeks to process with traditional techniques but just hours with the right technology, supported by the lean manufacturing toolbox.

Third, labor costs are rising. Before the COVID-19 outbreak the tight labor market was driving up labor costs and forcing companies to take on people with lower-than-desired skills at higher costs. Wages will continue to rise.

Finally, manufacturers in other countries have been investing. China, Japan, and Korea lead the world in installed robots and advanced manufacturing technologies in many fields. They have a head start in labor-saving technology that gives them a competitive advantage over domestic competitors.

All this has made continuous improvement more important than ever. Unfortunately, many improvement initiatives tend to underperform. Recent surveys have revealed that focusing on traditional lean manufacturing improvements has yielded unimpressive gains in productivity—just 1% to 2% in some cases—with marginal success in reducing work-in-process (WIP) and lead times. Yes, some heralded companies achieve double-digit improvements, but most firms struggle to achieve significant tangible gains.

When labor was plentiful and relatively cheap and most competing manufacturers had similar technologies, a traditional lean manufacturing approach made sense. Such operations had large pools of improvement opportunities. Non-value-adding steps comprised more than 85% of process lead time. Costs for waste included labor, WIP, rework, scrap, and lost capacity. Shortening setup times and implementing workcells along with 5S and preventive maintenance unlocked sufficient gains to enable growth and some productivity gains.

Historically, a gradual improvement approach worked for most situations. Today many operations just don't have this kind of time. This isn't to say lean manufacturing doesn't work. Quite the contrary. In fact, lean manufacturing disciplines form the bedrock of improvement success. They reduce chaos,

Manual Process – Multiple Machines & Setups

1. Cut Flat Pattern → 2. Punch Aperture → 3. Punch 8 Pilot Holes → 4. Punch 2 Large Holes → 5. Punch 6 Flange Holes → 6. Bend 2 Ends – 2 Ops Each → 7. Bend 2 Sides 8.2 Ops Each

Lead Time: 2 Weeks

▲ = WIP Accumulation, Machine Setup, Material Handling, Deburring

OPERATIONS	CUT FLAT	PUNCH APERTURE	PUNCH PILOT HOLES	PUNCH LARGE HOLES	PUNCH FLANGE HOLES	BEND ENDS	BEND SIDES	TOTALS
Set Up	1.0 hr.	0.50 hr.	0.25 hr.	0.50 hr.	0.50 hr.	0.50 hr.	0.50 hr.	3.75 hr.
Run	4.0 hr.	0.35 hr.	0.35 hr.	0.50 hr.	0.50 hr.	2.0 hr.	2.0 hr.	9.7 hr.
Scrap Pcs	5	2	2	1	1	3	2	12

FIGURE 2
Using traditional techniques, a fab shop must bring an enclosure through seven separate manufacturing steps.

Manual Process – Intense 5S & Setup Reduction

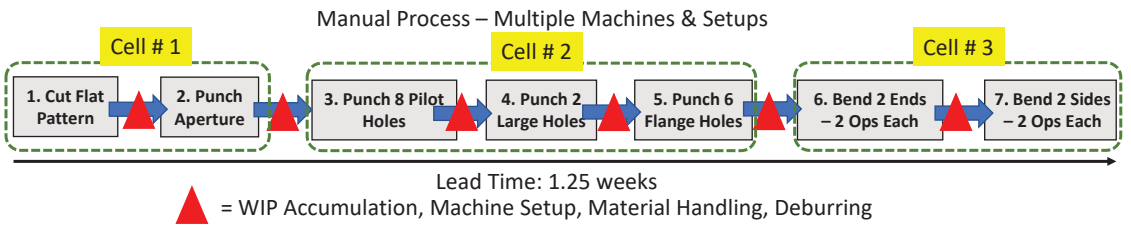
1. Cut Flat Pattern → 2. Punch Aperture → 3. Punch 8 Pilot Holes → 4. Punch 2 Large Holes → 5. Punch 6 Flange Holes → 6. Bend 2 Ends – 2 Ops Each → 7. Bend 2 Sides – 2 Ops Each

Lead Time: 2 weeks

▲ = WIP Accumulation, Machine Setup, Material Handling, Deburring

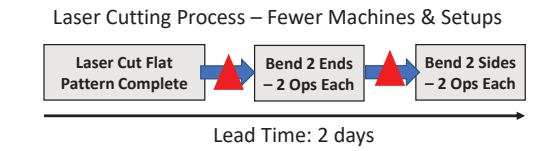
OPERATIONS	CUT FLAT	PUNCH APERTURE	PUNCH PILOT HOLES	PUNCH LARGE HOLES	PUNCH FLANGE HOLES	BEND ENDS	BEND SIDES	TOTALS
Set Up	0.25 hr.	0.13 hr.	0.08 hr.	0.13 hr.	0.13 hr.	0.13 hr.	0.13 hr.	0.94 hr.
Run	4.0 hr.	0.35 hr.	0.35 hr.	0.50 hr.	0.50 hr.	2.0 hr.	2.0 hr.	9.7 hr.
Scrap Pcs	2	1	1	1	1	1	1	8

FIGURE 3
Basic improvements using 5S, setup reduction, and mistake-proofing shrink the lead time to 13 days.



OPERATIONS	CUT FLAT	PUNCH APERTURE	PUNCH PILOT HOLES	PUNCH LARGE HOLES	PUNCH FLANGE HOLES	BEND ENDS	BEND SIDES	TOTALS
Set Up	0.25 hr.	0.13 hr.	0.08 hr.	0.13 hr.	0.13 hr.	0.13 hr.	0.13 hr.	0.94 hr.
Run	4.0 hr.	0.00 hr.	0.35 hr.	0.50 hr.	0.50 hr.	2.0 hr.	2.0 hr.	9.35 hr.
Scrap Pcs	2	1	1	1	1	1	1	8

FIGURE 4
Organizing equipment into cells shortens lead time to 10 days.



OPERATIONS	LASER CUT	BEND ENDS	BEND SIDES	TOTALS
Set Up	0.25 hr.	0.13 hr.	0.13 hr.	0.50 hr.
Run	3.0 hr.	2.0 hr.	2.0 hr.	7.0 hr.
Scrap Pcs	1	3	2	6

FIGURE 5
Integrating laser cutting causes lead times to plummet to just two days.

minimize non-value-adding steps and costs, and enable advanced technologies, including automation, to provide the best return on investment. Many factories have islands of automation surrounded by an ocean of waste, including many underutilized investments.

The following foundational elements of lean manufacturing are central to support any advanced manufacturing technology:

- *5S*. Sustained workplace organization is key from day one.
- *Visual work instructions.* This enables operators to adopt the new technology faster.
- *Cross training.* Making sure all operators on all shifts know how to use the equipment properly.
- *Setup reduction.* This is critical for minimizing lost time and capacity on new investments.
- *Preventive maintenance.* Implement the disciplines to maintain the new machines properly to ensure their long life.

Smart Manufacturing

Purpose-built automation often processes high-volume/low-mix products, but not all automation is so inflexible. Consider cobots, simple pick-and-place devices that can be trained by an operator quickly without programming.

Today, so-called "smart" machines can automatically compensate for variations in material characteristics and incorporate sophisticated vision systems to pick, place, and inspect features quickly and accurately. For example, one fabricator integrated an automated loading and unloading system from a tube bending cell. The problem was that the tube bending machine couldn't account for material variability, and because of the nature of the process and other circumstances, reducing tube variability simply wasn't an option. So the company invested in an advanced CNC bending system that automatically accommodated for material variability.

How Automation Builds on Lean

Imagine an old-school sheet metal shop with no laser cutting, not even a CNC turret punch press—just a collection of shears, single-station punching stations, and a few aging press brakes. Now consider the common fabricated metal enclosure in **Figure 1**. With old fabrication technology, the part requires seven separate manufacturing steps with separate setups, extensive material handling, setup scrap, and long lead times (see **Figure 2**). Every 100-piece order takes 14 days to complete.

Logical lean improvements include 5S, setup reduction, and mistake-proofing. An aggressive approach shortens setups by 75%, reduces setup scrap significantly, and shortens lead times (see **Figure 3**). Lead time shrinks to 13 days.

The next step involves workcells. Creating workcells can be a challenge in fabrication settings because of layout constraints, the cost of moving machinery and utilities, and training operators to perform multiple tasks within a cell. And yes, single-piece flow within one cell may not be practical because of the product mix, labor content, and required skill sets. But for the right application, workcells in fabrication, especially those dedicated to a certain product or product family, can work quite well.

Consider again the metal enclosure in Figure 1. Instead of flowing through a seven-step process, it could flow through just three workcells. In the first cell, one operator tends both flat cutting and aperture punching, all without losing throughput. The other two workcells have the same labor and content as in the previous seven-step process, but they're arranged so that parts flow faster, reducing lead time and WIP (see **Figure 4**). Lead time shrinks to 10 days.

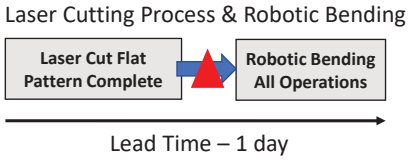
At this point, the shop has shortened the enclosure's lead time by almost 30% (14 down to 10 days). But what happens if the shop invests in a laser cutting machine that could cut the blank, the aperture, and all of the pilot holes (see **Figure 5**)? From the laser, the product flows to two CNC press brakes, each of which performs two forming operations. No surprise, lead time plummets to just two days—a reduction of 68%.

Taking it one step further, let's say the fabricator installs one robotic bending cell adjacent to the laser. Now, the laser cuts the flat pattern complete, and the robotic press brake, thanks to automatic tool changes, completes all bending (see **Figure 6**). The level of scrap plummets, and lead time drops again by another 50%, to just one day.

Key Takeaways

If you compare each scenario (see **Figure 7**), some performance indicators jump out. Lead time is reduced by 80% to 90%, resulting in a corresponding reduction in WIP and working capital. The level of scrap plummets by 72%. Quality and repeatability also are enhanced, and newer technology provides capabilities that older equipment cannot.

Flexibility also rises. This is particularly important as lot sizes shrink to meet unique customer needs.



OPERATIONS	LASER CUT	ROBOT BENDING	TOTALS
Set Up	0.25 hr.	0.25 hr.	0.50 hr.
Run	3.0 hr.	1.5 hr.	4.5 hr.
Scrap Pcs	1	1	2

FIGURE 6
Integrating robotic bending cuts lead times another 50%, to just one day.

Scenario	Lead Time (Days)	Setup Time (Hours)	Value-adding Time (Hours)	Scrap Pieces	Flexibility
Baseline	14	3.75	9.7	12	Low
Lean Mfg.	13	0.94	9.7	8	Low
Laser and Workcells	10	0.94	9.35	8	Medium
Laser and Bending Cell	2	0.50	7.0	6	High
Laser and Robotic Bending	1	0.50	4.5	2	High

FIGURE 7
Relying only on lean manufacturing shortens lead time from 14 days to 10. Building off these improvements with the right automation investment reduces lead time (and boosts throughput) by a factor of 10.

		Annual Hours				
Product Family	**Pieces/ Year**	**Op. 1**	**Op. 2**	**Op. 3**	**Op. 4**	**Total**
Filter Housings	210,500	69,465	65,255		18,945	153,665
Shelves	19,840	5,357	6,150	3,174		14,682
Supports	8,800		3,432		792	4,224
Hoods	6,201		1,922	992	558	3,473
Sconces	4,300	1,419				1,419
Frames	2,000		760	320	180	1,260
Totals		**76,241**	**77,520**	**4,487**	**20,475**	**178,722**

FIGURE 8
A product-process matrix, based on your defined product families, helps identify and build value streams.

In fact, flexibility in modern automation often is not fully appreciated. Years ago, for instance, a robotic bending cell would have required much larger lot sizes. Today, however, bending simulation and automatic tool changes have made small-lot and even kit-based automated bending a reality.

Note the role lean manufacturing plays here. You might look at the numbers and notice that the initial improvement shortened lead time by just one day, while automation shortened lead time (and, hence, boosted capacity) by a factor of 10. So, why not forget 5S and other lean tools and simply invest in the automation?

Again, lean manufacturing is the bedrock. If the operation hadn't invested in lean, costly automation would likely sit idle. Operators might take forever identifying and loading material into the laser. Part offloading from the laser wouldn't be coordinated, so an automated press brake would sit idle. Formed parts would be offloaded and pushed downstream even if those operations didn't have the capacity to handle the work.

Lean manufacturing provides the foundation that allows a fabricator to make truly massive productivity gains through automation. Quite often, however, fabricators hesitate to make the automation investment. For instance, many fabricators with laser cutting keep their forming operations manual. After all, the high-mix nature of the operation doesn't justify the investment—right?

Not necessarily. Again, modern automation is flexible. And if you can identify product families (discussed later), you might be able to maintain flow through the automation and, ultimately, benefit from enormous gains in throughput.

To put all this in perspective, lean techniques before technology investment shortened lead times by four days, a 28% reduction. Adding a laser reduced lead time by 80% (10 days to two). Again, many fab shops might stop there, but by doing so, they would miss out on another 50% reduction in lead time (two days to one) that bending automation could provide.

Of course, success isn't guaranteed. In fact, investing in the wrong automation can be extraordinarily costly. To avoid this requires the right strategy.

Avoid Automation Pitfalls

Investing in advanced manufacturing technology can be a risky matter. Many firms struggle with project selection, make mistakes during implementation, and hesitate to invest further. Some key reasons for project failure include:

- *Lack of an automation strategy.* Fabricators need a coherent plan to implement automation for optimal impact.
- *Limited automation skills.* Many small to medium-sized fabricators do not have the technical skills on staff to select projects and scope and manage them to successful completion. Young, inexperienced engineers tend to overlook risks, resulting in project delays or failure.
- *Poor project-scope management.* Managers include too many parts in the project scope, which can make a project quite difficult to implement.
- *High process variability.* Automated systems run best with little part-to-part variation in key characteristics.
- *Little to no risk mitigation.* Every project has risks. Identifying and mitigating risks throughout the project is critical and often overlooked.



To avoid these pitfalls, you need to tackle projects in a way that optimizes their impact and minimizes risks.

Step 1: Establish Goals and Objectives. Have clear improvement objectives and goals. The motivation for automation must be clear in the minds of ownership, plant leadership at all levels, and all production and support associates.

You might need to increase productivity and reduce labor content for specific product groups, improve safety, expand capacity, enhance quality, or add a technological capability. Your strategy might have multiple objectives. Regardless of how many objectives you have, though, make sure your automation strategy is rooted firmly in those objectives.

Step 2: Analyze Products and Create Product Families. Product families or groups of parts or assemblies should share specific physical characteristics and process steps.

Virtually all shops, even those with hundreds or thousands of individual part numbers, have product groups.

If you haven't identified product families, try printing the drawings of all the active parts and make stacks of prints that share similar configurations. This sounds very old-school, but it's an effective way to identify product families. Be sure also to involve key manufacturing personnel.

Step 3: Create a Product-process Matrix. Create a product-process matrix for each product family (see **Figure 8)**. Use the highest-volume parts to capture routing steps. This is the same process used to identify value streams using lean manufacturing techniques.

Step 4: Identify Possible Opportunities. Now the fun begins! There is no one right way to identify possible opportunities. You might focus your automation strategy on one product group. This can drive labor costs down, improve quality, and make an operation globally competitive. Some Asian appliance manufacturers have taken this approach and now achieve high margins dominating the small-kitchen-appliance market.

You could also select just one operation to automate. This approach cuts across multiple product families and presents some challenges, but it can be effective. For instance, punch/laser machines automate multiple fabrication steps for many parts and are very flexible.

Alternatively, you could focus on one troublesome operation. Some manual operations that require significant skills, are difficult to perform, or have high scrap rates can be prime targets for focused automation projects. An example is the cutting of holes in domed parts for pressure vessels. Manual cutting requires a significant amount of layout, tedious setup, and lots of grinding to repair, whereas a simple robot, proper fixturing, and a good plasma cutter can produce high-quality results quickly and safely.

Step 5: Evaluate Alternative Solutions. Review the value stream and operation in detail. Consider again the enclosure in Figure 1. The final solution happened to involve a laser and a robotic press brake with automatic tool change. But could some forms be made on a CNC punch press or punch/laser combo? And if so, how would that change the forming situation? Would a robotic bending cell be the most effective, or would a stand-alone press brake with automated tool change offer more flexibility, or perhaps an automated or semiautomated panel bender? Contact multiple service providers and explore your options. Do not fall in love with one solution!

Step 6: Integrate With a Lean Environment. Finally, plan to integrate the new technology with the entire value stream. Include key disciplines from day one to make it a success and ensure sustainability. Some major considerations include:

- *5S.* Organize and label all tools, punches, cutting tips, and accessories along with inspection tools. Create a lean environment with audit checklists and schedules.
- *Create visual work standards.* Write clear, crisp work instructions to set up, operate, and maintain work centers.
- *Institute preventive maintenance.* Train internal maintenance personnel and create a regular maintenance schedule.
- *Update value streams*. The new automation is now a work center like all others. Adapt it to your value stream framework and see where other opportunities exist.

The Path Forward

Automation is here to stay. Successful firms embrace the improvements in flow, process consistency, process simplification, and safety that these investments bring.

Automation is not only compatible with lean manufacturing but necessary to compete in the modern economy. Manufacturers in other countries have proven how automation and lean practices go hand in hand. Finding the synergy is doable with the right skills, approach, and commitment.

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The pros and cons of complex bending in a design

Bends have advantages, such as reduced part count, but sheet metal origami requires labor

By Gerald Davis

An assembled and exploded tote box tray is shown in **Figure 1A**. This design requires spot welding for the end plates and dividers. Riveting is specified for the handle. This project caught the attention of Reader Rick when he saw it in the February 2021 episode of this column. He observed that the end panels, as separate parts, introduce avoidable complexity and weakness.

His suggestion eliminates two parts from the flat nest, highlighted in **Figure 1B**. The frame floor and tray ends are to be bent from a single piece of metal. We shall explore Rick's suggestion.

Figure 2A shows legacy features that carry forward into the new design. We will keep the holes and the top flange for the handle attachment. The hemmed edges provide some safety and stiffness, so we'll keep those. And the vertical flanges help keep things from falling out of the tray.

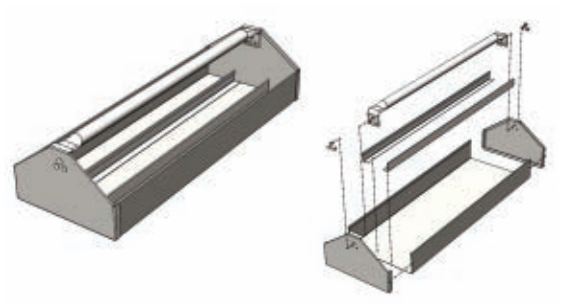


FIGURE 1A
This tote box tray (shown assembled to the left and exploded to the right) has separate end pieces that require welding. Why not make them part of the floor to start with?

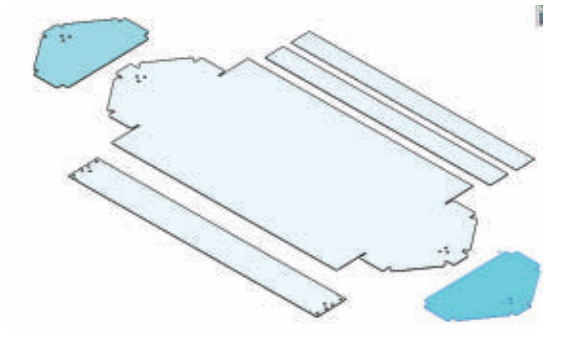


FIGURE 1B
A suggested change is to bend the end pieces in place instead of welding them on after bending. The two separate end parts (highlighted) will be deleted from the design.

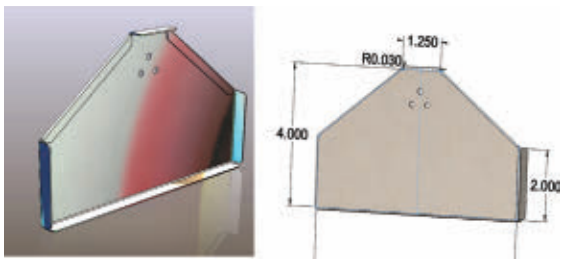


FIGURE 2A
Legacy features we need to carry forward are holes, hems, and flanges. The target sizes are noted.

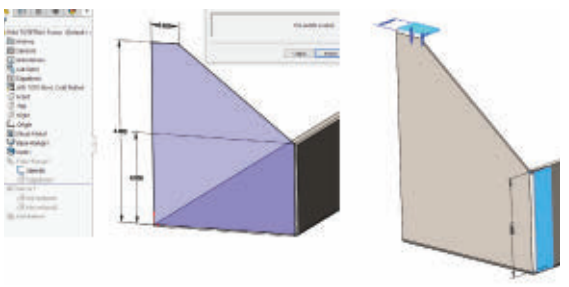


FIGURE 2B
A two-step CAD technique is used to create a sheet metal flange. In Step 1 (left), the sketch for the sheet metal flange is edited to include the diagonal slope. In Step 2 (right), two flanges are added as a single feature because they share the same depth.

Mirror, Mirror to Save Time

As foreshadowing, this change is going to be modeled as a sheet metal flange, followed by sheet metal flanges, followed by a hem. That result will be mirrored and mirrored to complete the tray. There are many alternative methods for modeling this project. This demo is trying to show a shortest-path collection of CAD techniques.

The sketch for a sheet metal flange is shown to the left in **Figure 2B** (menu path to this sketch is Sheet Metal>Edge Flange>Edit Flange Profile). The sketch roughly matches our legacy 4-in. overall height and 1.25-in.-wide handle tab.

The two other legacy flanges are modeled as a single edge flange feature, shown with highlight to the right in Figure 2B. The author went with two flanges in a single feature because they share the same depth. It might be clearer for future editing to have modeled these as separate features.

The next legacy item is the hemmed stiffener along the diagonal edge. **Figure 3A** shows the sketch for the hem feature and the completed hem. The hem's sketch was edited for good result in the flat layout. **Figure 3B** shows the sheet metal tray frame after two mirroring features are completed.

The holes for handle rivets are the next task.

The new unibody sheet metal frame is shown in **Figure 4A**. Magically, the rivets shown (to the left) are passing through the sheet metal shown in Figure 3B. As a side note for this demo, the rivets were modeled as a derived pattern based on the hole pattern in the handle part.

To demonstrate a solution to a design intent, the rivet holes (to the right in Figure 4A) were created using an Assembly Feature (Insert>Features>Assembly Feature>Hole>Hole Wizard). The setting for "propagate to selected" is selected, and only the tray gets the treatment.

The design intent for the rivets is to have the handle's design control the location of its rivets in the frame. The handle design is suspect because of its arcane method of construction.

The completed tray, shown in **Figure 4B**, has a lovely unibody construction. Perhaps the corners are spot welded, or perhaps the handle is enough to tie this box-kite frame together rigidly.

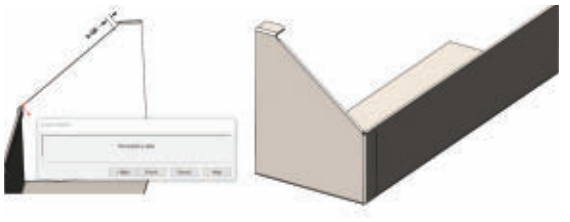


FIGURE 3A
A sheet metal hem feature is added to stiffen the diagonal edge. The hem's sketch has been edited (left) for good result in the flat layout. For extra credit, adjust the length of the hem to match the 90-degree flanges to reduce the backstop movement needed on the press brake during forming. The result (right), where the changes to the end bends are complete for one-quarter of the tray, is also shown.

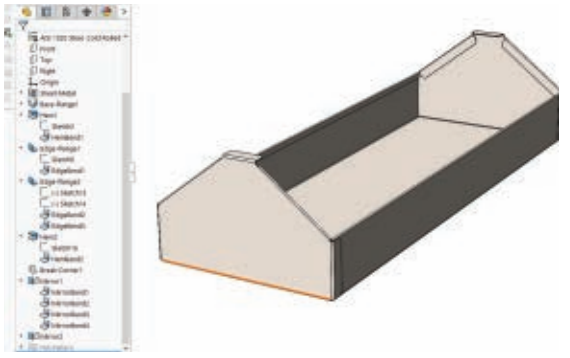


FIGURE 3B
The Feature Manager (left) shows that we've added a mirror of a mirror of a body to model the other three tray corners. The rivet holes await.

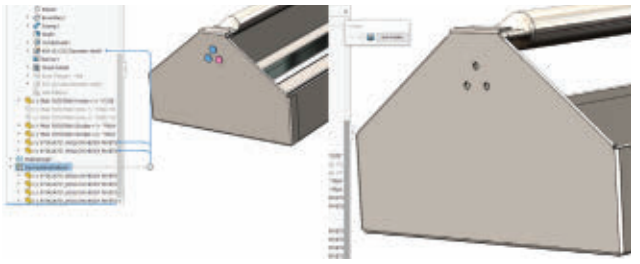


FIGURE 4A
The rivets (left) are modeled as a derived pattern based on holes in the handle. The rivets don't realize they need holes to pass through. Suitable holes are modeled using an Assembly Feature (right) that are parametrically linked to the handle's model.

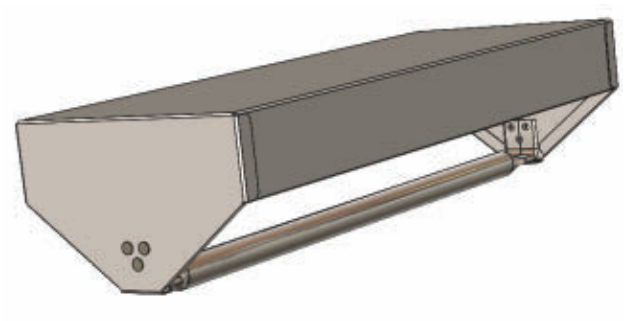


FIGURE 4B
The tray, shown upside down to reveal the unibody construction, has been updated.

Design Review

So now we chat to see if we got Rick's suggestion right. And ponder upon change for the better.

Hemming on a press brake is dramatic, requiring lots of time wildly flopping sheet metal. While it is not so bad on a folder-style bender, hemming is still at least a two-step process—make an acute bend and then spank it down to complete the 180-degree bend.

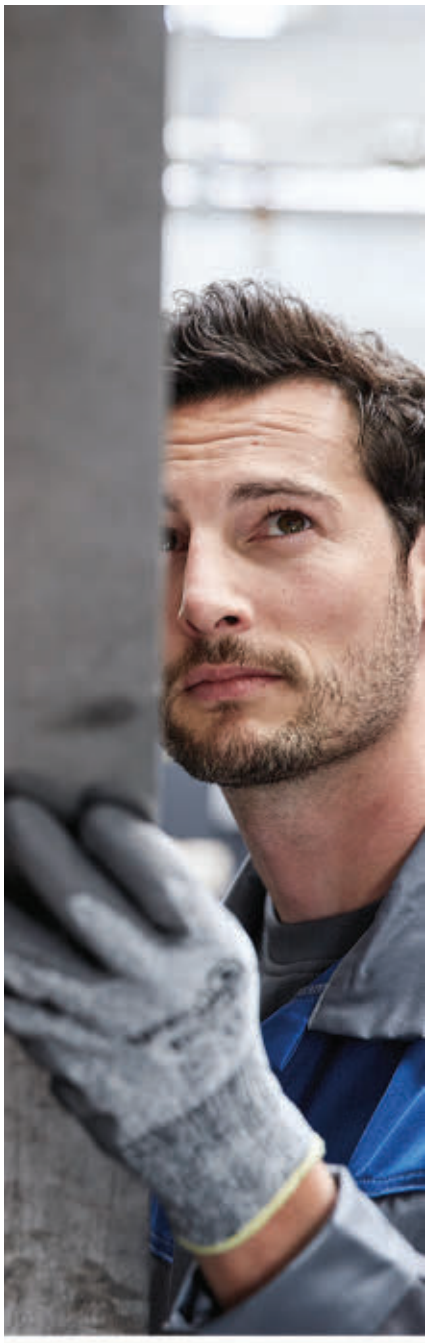
There are many alternative methods for modeling this project. This demo is trying to show a shortest-path collection of CAD techniques.

With drama in mind, the separate end pieces, being smaller flat blank pieces, might have been easier to fabricate than the unibody version is. Even though the welding adds time, much less time is spent part handling during the origami stage.

Less welding is always a blessing. Fewer seams mean fewer leaks. The bends add floor strength while reducing the overlap weight. Having fewer parts on the BOM also is a tremendous improvement.

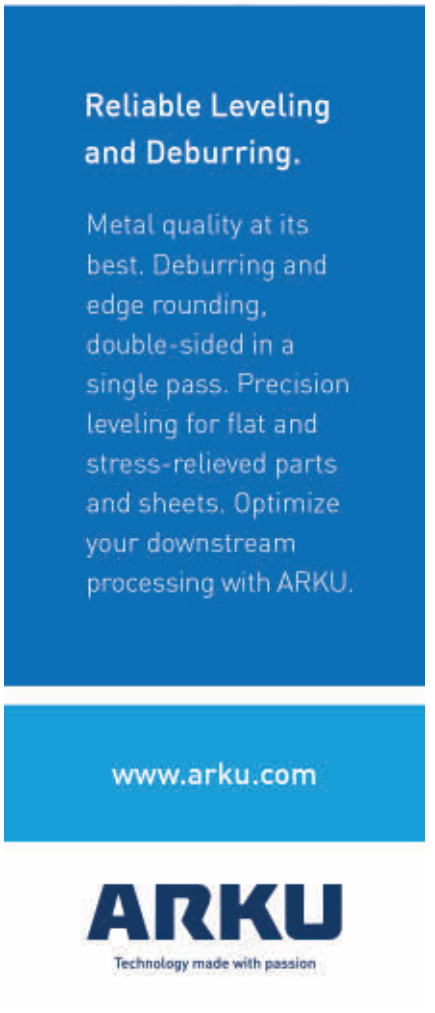
Could we apply this same design inspiration to the main box? Would the box depth be too much for the brake? Will the handle be redesigned?

Gerald would love for you to send him your comments and questions. You are not alone, and the problems you face often are shared by others. Share the grief, and perhaps we will all share in the joy of finding answers. Please send your questions and comments to dand@thefabricator.com.











Read more from Jeff Sipes at
www.thefabricator.com/author/jeff-sipes

Avoid improvement overload

Your goal is to create the most effective work environment

By Jeff Sipes

Avoid improvement overload. Doesn't this sound like an odd statement for a continuous improvement column? It implies that you are always working on improvement…as you should. But how effectively are you managing your lean journey? Do you keep piling on more projects and more work, all in addition to the work that needs to be done to get products out the door on time at expected quality levels and at target costs?

The problem of improvement overload could be real or just a perception based on a miscommunication. The degree to which it is reality or perception may vary depending on where you are in the company. Regardless, a disconnect between reality and perception in your organization could be a serious, lurking problem. Let's explore how to identify and handle improvement overload.

Signals of Overload

Improvement overload happens when the organization simply takes on too much too soon and too aggressively. People might be openly dismissive or vocal about the next improvement project ("We have to do this in addition to everything else?"). Or they may quietly grumble, express apathy, and exhibit a more subtle defiance. Your ability to see the signals, and whether the overload is real or perceived, can prevent the issue from festering and help keep your lean journey on track.

Several direct signals can indicate you may be experiencing improvement overload. You go to your industrial engineer and welder with the news that plant leaders have an improvement project in mind and you want them to be involved. They say something like, "Boss, we are already working Saturdays and barely keeping up. How can you expect us to spend time with this new project?" This indicates you have a capacity or interest issue.

Another direct signal might be when key people simply stop showing up to improvement events. They always have a reason for missing. Maybe they had to get an order out the door, were tied up in another improvement project meeting, or just forgot. Whatever the case, they are not putting effort into the new project.

Subtler reactions to improvement overload are the worst and may be harder to see. For some, the feeling of overload can drag down their overall performance. They don't decline all at once but instead slowly slide to a dark place. You may be left wondering why previously stellar performers seem to be slipping away.

Another subtle signal is when people show antipathy toward the next new improvement project. They don't say "No." Rather, they grudgingly go along and say, "Sure, pile another one on me. I'll find some time somehow." That is not a resounding endorsement.

You get the idea. Some signals are clear, direct, and hard to miss. Others are below the surface and harder to detect. Your job is to be an advance scout; be aware when the signals emerge; and make sure the issues, whether real or perceived, are addressed.

Techniques to Avoid Overload

Observing the signals and then doing something about them is a bit like performing a quality check at the end of production and then taking corrective action. It's too late. The damage is done. In production you need to conduct upstream vigilance and attempt to mistake-proof (*poka-yoke*) a process so mistakes cannot occur. Similarly, you can use the same techniques to avoid getting to the point where improvement overload becomes an issue.

It's about getting ahead of the problem, and one way to do this is to have an effective project charter that spells out the business case, problem statement, goals, scope, and team members. If these items are clearly, concisely, and quantitatively defined, you will reduce confusion around expectations. The business case addresses why you are doing the project. The *problem statement* describes the situation as quantitatively as possible. A *goals statement* highlights what to improve, by how much, and by when. All this helps you avoid ambiguity.

Also, try designing improvement projects in bite-size pieces, allowing for crisper starts, stops, and transitions. When resources are already stretched, an open-ended project can be demoralizing because it may not be clear when it ends, how many resources should be applied, and where it rests in terms of relative priority. Reduce the stress by making the improvement work bite-size and discrete.

You can get a sense of the overload status by listening closely and observing the behavior of those directly and indirectly involved in improvement projects. Do you see energy and enthusiasm or half-hearted blind compliance? Rattling on about a new project (particularly if the boss is pushing it) is easy. Listening for deep understanding is hard. Insight about improvement overload comes from effective listening.

You occasionally should measure your improvement work load capacity. You may find that there is legitimate need to reprioritize projects based on new stimuli, either from the external marketplace or from internal matters. Or you might find that some projects should simply be ended because they've run their course. A project might have reached a point of diminishing returns, or the improvement team might have reached its full potential.

Think of this as selectively pruning the improvement project portfolio. Also, sharpen your design, selection, and execution of new improvement projects. The better you do this, the more effective your lean journey will be.

Assess Your Improvement Load

How can you assess your current situation? One way is to create an improvement portfolio, much like you would your investment portfolio. Take inventory of all your current and proposed improvement projects. Assess them for significance. How do they help execute your business plan? How do they affect customer satisfaction? How many projects have short-term versus longer-term time frames? Are they on track? For all open projects, note the degree of completion, how they compete for scarce resources, and other criteria that may be particular to your company. After pulling this information together, you can make decisions about changing priorities, being more or less aggressive, pruning selected projects, and rebalancing your scarce resources across targeted projects.

You also can rely on voice-of-the-customer techniques. In this case, you're focusing on internal customers—your employees. Speak to employees at

every level of the organization to get their perspectives on improvement project stability or overload. You could gather voice-of-the-customer feedback through either formal or informal surveys.

Focus on both real and perceived concerns. The perceptions may be based on miscommunications or a lack of understanding. Rather than seeing this as a problem, consider it an opportunity to develop clarity and alignment.

Try using a project-close-out assessment tool to ask project team members, sponsors, and support staff (such as lean *sensei*, training staff, or HR) for feedback on the upside and downside of the project. Did they have adequate time to devote to the project without creating problems somewhere else? Were they conflicted about supporting multiple projects and still getting everyday jobs completed? Did they ever feel like they were spread too thin?

Whatever its form, the assessment should help you objectively understand where you stand in terms of improvement overload. It can be an early warning that signals you to adjust your improvement portfolio, priorities, and timing, and thereby avoid the sense of overload your employees may feel.

Create an Effective Work Environment

Yes, avoiding improvement overload sounds odd, especially in a column about improvement. But it really is an important topic, particularly during times when you are asking people to do more with scarce resources.

Avoiding improvement overload doesn't mean you should back off. Rather, it means that you need to be critical and objective about how you deploy your improvement resources and set priorities. By understanding where, how, and when improvement overload might occur, you can make decisions early that will help avoid overload problems later.

Whether managing reality or perception, you must understand your employees' ability to effectively take on "one more project." Pushing too far or too hard can hinder progress on specific projects as well as the overall lean journey. Find a balance to get the best results. The goal is to create the most effective work environment for your employees.

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And just like that … your profits are gone

What can happen when you don't design for the press brake

By Steve Benson

A poorly designed part can frustrate your press brake technician, create inconsistent parts, lower part quality, increase scrap rates, and just like that … your profits are gone. The good news is that it does not need to be that way. With a little forethought and knowledge of basic sheet metal design rules, many common forming issues will magically disappear.

Minimum Flange Height

What is the minimum flange height possible in a given part? This depends on the style of bend, die opening, die radius, punch nose radius, and forming method. In a straightforward bend (see **Figure 1**), the flange height should be at least two times the material thickness plus the inside bend radius. This works under perfect conditions, using the correct die-width-to-bend-radius relationship. Even though the part's circumstances may vary, the rule still holds. (This doesn't address the minimum flange over a specific die width, which I'll cover later.)

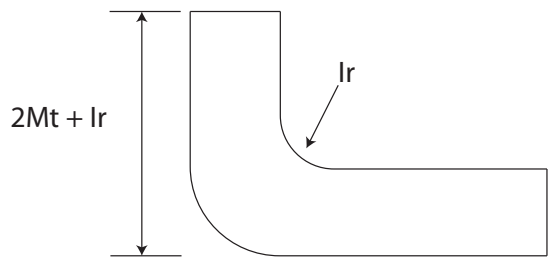


FIGURE 1
The minimum height of a straightforward flange should be at least two times the material thickness plus the inside bend radius (2Mt + Ir).

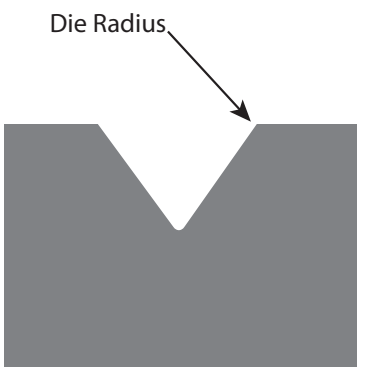


FIGURE 2
The die radius is located at the top two corners of the die.

Die Factors

The die opening and the die radius (see **Figure 2**) play a significant role when the flange height is at or near its minimum. Press brake die radii can have either a sharp edge or a compound-radius edge.

Sharp-edge die radii are designed to catch short flanges. The compound-radius corners are designed to reduce the amount of die marking found on the part after forming, caused by kinetic friction between the sheet metal and the die. As the punch applies force, it pushes the material into the die space to create the bend. That same downward force is being applied at the die radius. As the part is pushed into the die space, it drags the sheet over the die radius; that dragging motion can scar the material surface.

If your die has a compound or large radius on both corners of the die, the formula—Minimum flange = 2Mt + Ir—may no longer be valid. Why? Because the sheet edge might not catch the edge of the die, and the workpiece probably will snap down into the die space. If the part does catch by chance, the bend may not be acceptable as every bend will be slightly different from the last. If you need to bend very short flanges, you usually will need a die with a sharp radius.

One option might be to go to a narrower die width, where the compound radius might catch the flange and make the bend. But you have other issues to deal with, tonnage being the primary one. You could end up bottoming the punch in the smaller die, which will change the inside bend radius, the bend allowance, and the bend deduction.

A *perfect bend* is where the inside bend radius is equal to the material thickness. This is where the *8x rule* for die selection applies: The die width or opening is equal to eight times the material thickness. You might be able to go to a 6x die opening safely, which can allow the die to catch the flange edge and make the bend. However, you need to ensure you know how to go to a 6x die width safely, because improper use or an overtonnage situation can damage the tooling and the press brake and, even worse, possibly injure the operator.

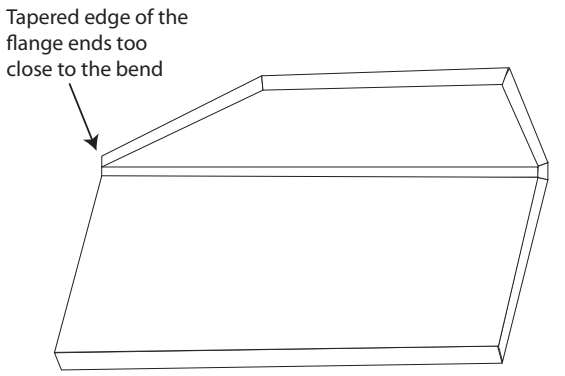


FIGURE 3
A tapered flange that ends close to the bend line will distort badly.

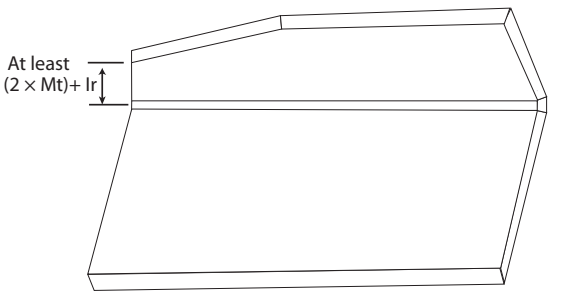


FIGURE 4
A tapered flange ideally should end at a point that's at least two times the material thickness (Mt) plus the inside radius dimension (Ir).

Tapered Flanges

If you form a flange that's tapered down to the bend line, you'll see a significant amount of distortion in the bend (see **Figure 3**). Once the taper hangs out over the die space, the flange is no longer supported by the die shoulder and die radius. The material that is supported by the die radius will bend upward as it should. However, the flange's tapered, unsupported area will bend downward from the die radius to the bend's center, opposite from what is needed. This creates a convex area along the bend and causes the part to twist under the punch nose. This twisting will taper the bend angle and the height dimension of the flange, usually throwing the workpiece out of tolerance.

You could use a smaller die opening, but that would only limit the deformed area's size, so using a smaller die width is not the best option.

What will work is modifying the part design so that the taper's inner edge ends at a point that's two times the material thickness plus the radius dimension (see **Figure 4**).

However, in some cases you cannot change the design, so what can be done? Another option might save the day. Wrapping is one way to correct a flange blowout. Again, the problem we face is that part of the flange is bending up and part of the flange is bending down, causing various dimensional and angular issues.

When this happens, you may be able to add a piece of material to the forming operation. The wrap material needs to be the same type or stronger, equal to or thicker than the workpiece material, and, of course, be a full piece with no taper. You'll need to use some common sense when picking a thickness for the wrap as there is no fixed rule.

Once you decide the wrap material and thickness, you can use a little math to calculate a new combined thickness. Add the wrap material thickness to that of the workpiece thickness, then calculate a new die opening capable of forming the new combined thickness. You'll be bending two pieces of material at the same time, and your bend calculations need to account for this (see **Figure 5**).

The wrap needs to be just long enough to cover the bend length and wide enough to cross the die opening completely. Being a full piece without taper, the wrap will form as it should, as will the tapered workpiece it's supporting. You will likely need to set a sidegauge to locate the part and wrap to the right or left to ensure the backstop fingers contact the same workpiece location repeatedly. That's because even with the wrap, the part will still pull during bending, which can induce some taper in the bend itself. Using both a sidegauge and backgauge helps square the bend.

This method also works well on part features that tend to make the part pull during bending, such as holes, cutouts, and other features close to the bend line. Using a wrap in these situations isn't a perfect fix, but it might just save a run of parts until some changes can be made.

Forming Method Options

You probably air-form (or air-bend) your parts, which is a good thing if you understand how it works. Air forming floats the inside bend radius as a percentage of the die opening. Unfortunately, the forming method can make the workpiece susceptible to twisting and distortion in flanges that are too short.

Bottoming and coining are different, as they stamp the inside bend radius into the material. Additionally, these methods are associated with a tight inside bend radius and the punch having a small nose radius. This creates a sharp-bend situation, typically something you want to stay away from when air forming.

With coining, of course, creating a sharp inside radius is the point, and it is an option for bottom bending. To some extent these forming methods

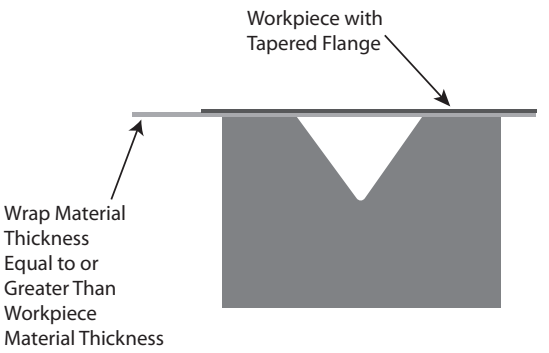


FIGURE 5
Forming a workpiece with a backup or wrap helps eliminate distortion of a flange or feature.

can reduce the amount of distortion found in a tapered flange by forcing the material deeper into the die. Still, this is not the best option as there will still be some taper and blowout of the bend, even after you spend time tweaking the back- and sidegauges.

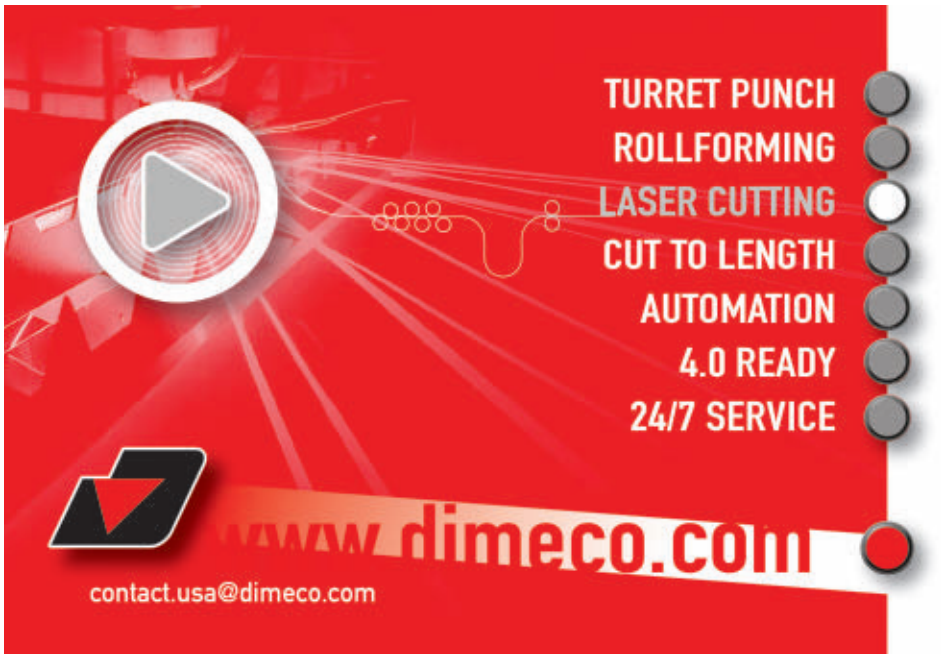
Do not forget that performing bottoming or coining increases forming tonnage significantly. Also know that if you do change from air forming to bottoming or coining, you will also need to accommodate for the change in your bend allowance and bend deduction.

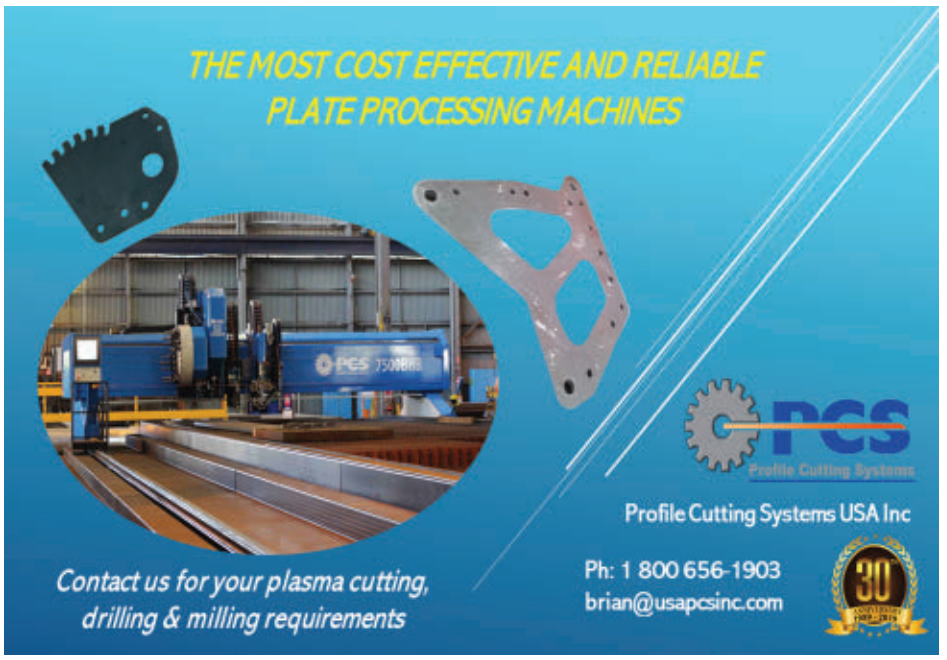
Mind the Flange Height

Note again that all this relates to the minimum flange dimension for a given part, *not* the minimum flange possible over a given die opening, a related but different subject that I will be taking up in a future column.

Regardless, when designing parts, keep your flange height at least two times the material thickness plus the inside bend radius, especially if the flange tapers off. A part redesign might not be possible, but the two options discussed here—wrapping and choosing an alternative bending method—might save the day.

Steve Benson is a member and former chair of the Precision Sheet Metal Technology Council of the Fabricators & Manufacturers Association International®. He is the president of ASMA LLC, steve@theartofpressbrake.com. Benson also conducts FMA's Precision Press Brake Certificate Program, which is held at locations across the country. For more information, visit www.fmamfg.org/training, or call 888-394-4362. The author's latest book, *Bending Basics,* is now available at the FMA bookstore, www.fmamfg.org/store.







An operator adjusts a nest of parts, delivered to the machine via OSH Cut's custom software.

A fabricator for the Amazon generation

Utah shop shows the potential of automated order processing

By Tim Heston

Watch OSH Cut's shop floor in action and you might think you're witnessing a typical precision sheet metal fabrication startup. The company launched in 2018 with one fiber laser. It now has two lasers, one press brake, and 14 employees—nothing out of the ordinary there.

Look a bit closer, though, and you'll find some oddities. First, you won't see anyone in an office creating or cleaning up 3D CAD files. Where are the sales and estimating teams? Where are the engineers cleaning up customer files? Who's processing the orders? Who's scheduling the shop? No one. It's all automated, handled by software designed and written by the company's co-founders.

Some hands-on work remains. For instance, machine operators do perform some manual tasks before initiating a program. But for the most part, the entire front-end process, from quoting to the first cut, requires no human intervention. If OSH Cut's success continues, its story might prove how transformational software could be for the precision sheet metal fabrication business.

Inspiration From Custom Printed Circuit Boards

Caleb Chamberlain didn't grow up in metal fabrication. An electrical engineer, he spent years designing and ordering custom printed circuit boards. "In the custom circuit board industry, you can go anywhere online, visit one of hundreds of companies, place an order, and have that circuit board sitting on your doorstep the very next day if you need it. And you can do it all without talking to a person. You upload your designs; you receive instant manufacturability feedback on your parts; and you choose your lead times, balancing costs and lead times to receive the part as quickly as practical. That's just the way the industry is.

"But when you look at sheet metal fabrication, in spite of the fact of it being 2021, that's often not the case. The electronics industry is really setting the standard for what's possible, from a responsivity and customer-experience perspective. And I think that is driven even more by the fact that we live in this Amazon world, where you can get anything on your doorstep in a day if you need it."

As an electrical engineer in need of sheet metal components, Chamberlain sometimes waited days or even a week or more just for someone to call or email back. He knew there was a better way. The custom PCB industry had thrived with automated quoting and order processing, with customers uploading design files to a website and receiving quotes instantly. Why couldn't this work for custom sheet metal fabrication?

From this came OSH Cut, which Chamberlain—along with his father Chuck, his brother Jacom, and his brother-in-law McKay Christensen—launched in the middle of 2018. Chuck, who spent a few decades in the power plant industry, is the company's safety officer and works two to three days a week. McKay, a software engineer, helped Caleb with some initial software development and now serves an advisory role.

OSH stands for open-source hardware. "It ironically has very little to do with the company now," Caleb Chamberlain said. "Our original intent was to create a portal where people could upload, share, and order designs. But after we started, we pivoted fairly quickly to fill a more B2B-oriented need, and here we are with a legacy name."

One component of the name still applies in a way: The ability to upload a part file, or series of part files, to the quoting engine at oshcut.com is, in effect, open to all, as long as the file is in DXF, SVG, or Adobe Illustrator format. By the end of the second quarter, the company plans to integrate software features that would allow the upload of most native file formats, including SolidWorks, Inventor, IGES, and STEP.

From there, OSH Cut's proprietary software generates the quote, processes the job, and postprocesses numerical code to the company's two fiber laser cutting machines—a 3-kW TRUMPF laser and an 8-kW Mazak machine—along with a bend definition file to a 150-ton Mitsubishi press brake with a 10-ft. bed.





Every batch of parts is bundled together and labeled with a bar code. This tracks how the parts flow through the shop and ensures the correct parts go into the correct box for final shipping.

About Revenue Concentration

In 2019 custom fab respondents to the "Financial Ratios & Operational Benchmarking Survey" reported that, on average, just seven customers made up more than 50% of company revenue. That's up from previous years; in 2018 the average was only four.

High revenue concentration is typical in this business, where small fab shops grow into larger ones on the backs of a handful of large customers, and where shops make investments in machinery and automation to serve those large accounts. Buying a large machine after landing a large contract makes for a quick return on investment for that machine. All this in turn create a customer mix with a few large accounts at the head of a "long tail" of small-dollar accounts.

Chamberlain and his team are focusing on that long tail, and to do it they've automated not just quoting, but also the entire front-end process, from initial quote to right before the first cut. Broadly speaking, the shop's approach models those taken by the likes of Amazon and Google. Both companies have built empires not from large accounts but from millions, even billions of low-dollar sales. When someone buys a product from Amazon or an online ad from Google, they usually don't speak to a human. Automating the front end has helped make this kind of business scalable.

Building a Shop for the Internet Generation

OSH Cut's automated front end has several building blocks, the first of which involves control over material. The fabricator does not toll-process customers' material. "We stock everything we cut," Chamberlain explained. "This allows us to control sourcing."



The OSH Cut staff stands by the shop's 8-kW Mazak fiber laser with a laser source from IPG Photonics. Caleb Chamberlain, one of the company's founders, is third from the left. His brother Jacom Chamberlain, a mechanical engineer, is fourth from the left. McKay Christensen, Caleb's brother-in-law and the company's software engineer, is on the far right.

That control extends to both quality and quantity.

Regarding quality, a large portion of the company's sheet metal stock undergoes stretcher-leveling at the service center before being delivered to OSH Cut's stockroom. The process minimizes residual stress and, hence, the chance of certain pieces bowing upward after being cut.

Regarding quantity, the shop's software shows usage and profitability trends. "Everything lives in our database," Chamberlain said. "We know what our most profitable materials are and how much we go through in a month, so it helps us figure out how much to stock." He added that, on average, the shop has stocked about a month's worth of inventory, but again, that level changes depending on utilization. "Right now [in early 2021], because some materials are hard to come by and prices are really volatile, we're stocking a bit more to make sure we don't run into supply issues." At this writing, the shop is stocking more than 300 different types of materials and thicknesses.

Another building block involves some sophisticated remnant management. OSH Cut has no filler parts to draw from and no finished-goods inventory. Everything is cut and bent on demand, and the shop can't wait for other small orders to fill a sheet. So, adjacent to the company's laser sits a vertical rack full of remnants, each with a bar code. Once scanned, the remnant is stored within the company's inventory system, ready to be utilized for a future order.

The company's extensive use of remnants (many of them awkwardly sized) also has driven its material handling strategy, which at this writing remains largely manual. A fork truck retrieves sheet or plate, either from a designated rack or remnant storage, and places it adjacent to the lasers. Staged sheets then are moved via fork truck to the laser's shuttle table.

As Chamberlain explained, certain material handling automation technologies could be in the company's future, but as of now, the need just hasn't been there. Employing people to move material has helped support the company's remnant strategy. Moreover, the company's automated quoting and order processing effectively shave days or even weeks off the order-to-ship cycle. Even without automation, the company delivers orders faster than the competition; most are within five days, and some are within just one day.

OSH Cut does this with another building block: careful capacity management. “Our goal is to always have excess capacity,” Chamberlain said. “It’s core to our business model.”

Maintaining a buffer of excess capacity boosts part flow. Just as you rarely need to tap on the brakes on a highway with little traffic, a part flows quickly through a shop well below its capacity. Conversely, even a small issue in a shop near capacity can grow quickly into a major traffic jam.

Capacity levels are monitored continuously as customers upload parts for quoting. Using time estimates on cutting as a baseline, the software determines the maximum usage per machine, then reduces that to allow for 20% of unused capacity. “Our lead time engine [in the software] then uses this to decide what lead times to offer the customer,” Chamberlain said.

Operating below capacity absorbs variability, and in OSH Cut’s case, lead time is that variability. If a customer chooses to pay for next-day delivery, the fabricator needs that extra capacity to deliver. Overtime still happens, of course, but every time it does, the company works to uncover the root cause, asking why the automated production scheduler thought it could deliver something when the shop couldn’t. “Our goal is to [perfect our scheduler] so that overtime doesn’t have to happen,” Chamberlain said. “And we get a little better every day.”

He added that in the near future the shop hopes to use capacity data to institute incentive pricing, roughly analogous to the airline pricing model. If a certain kind of work (like a specific material grade or thickness) or promise date would help level-load the shop, the system would offer more competitive pricing. And because the work would help level-load the operation, the fabricator could maintain or improve its margin even while offering a lower price.

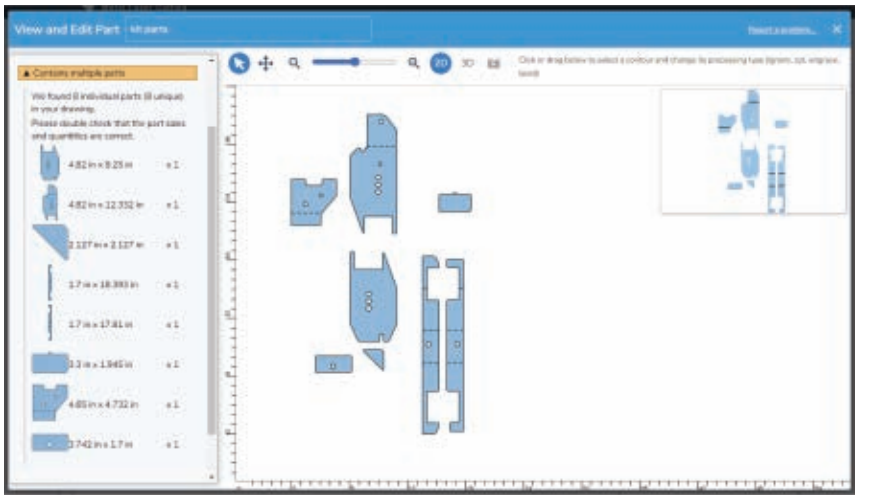
“The ultimate goal is to work toward leveling production and leveling customer demand,” Chamberlain said. “So, if you pick a delivery date of five days instead of three, we can add the job to this other quarter-inch job. We’d level the operation, improve efficiency, reduce overhead, and keep all our processes fed at the right rate and at the right time.”

Having a shop full of sophisticated equipment, all purposefully run well below their maximum capacity, flies in the face of traditional capex strategy and equipment efficiency metrics. So does the lack of material handling automation that often accompanies such high-powered machines (though, of course, the machines do have conventional pallet changers).

Moreover, the business model calls for a somewhat labor-intensive shop floor, with people loading and unloading material and, especially, inspecting and packing finished products. Of course, the business also delivers quotes nearly instantaneously and processes orders with little to no labor at all. According to Chamberlain, by the time competing shops respond to a quote request, OSH Cut has often already delivered the parts.



An operator monitors a cutting program on OSH Cut’s 3-kW TRUMPF laser.



Customers can upload single parts or, as shown here, groups of parts to the quoting engine.

Automating the Front End

Seamless order processing lies at the heart of OSH Cut. To that end, every order goes through the automated system. One employee in a customer service role does guide customers through the process and might make some part design suggestions, but the company can’t accept orders that don’t flow through the software.

This requires a very robust, reliable, user-friendly software platform. To make this a reality, Chamberlain and his software team had to overcome several challenges. One was to automatically correct common drawing attributes that don’t convert well into a cutting program.

Today the company’s quoting and nesting software detects splines (especially common in projects drawn in Adobe Illustrator) and converts them all to lines and arcs. “If we get a file with a million tiny line segments, our system will smooth those out automatically,” Chamberlain said.

The second challenge was having a robust design-for-manufacturability (DFM) functionality. Today, when a customer uploads files to OSH Cut, the system analyzes the part shape and highlights challenging areas, such as narrow points that might be susceptible to excessive heat buildup. It checks for piercing room, minimum hole sizes, and potential problems with extreme aspect ratios. “So, if we have a really long, narrow part,” Chamberlain said, “the software will recognize that heat buildup might be an issue.” The software not only flags the problem, but also identifies the severity, allowing the user to zoom in and out and manipulate the 3D image directly on the web page. It also gives the user the opportunity to identify the need for consistent grain direction for cosmetic reasons, bending consistency, or both.



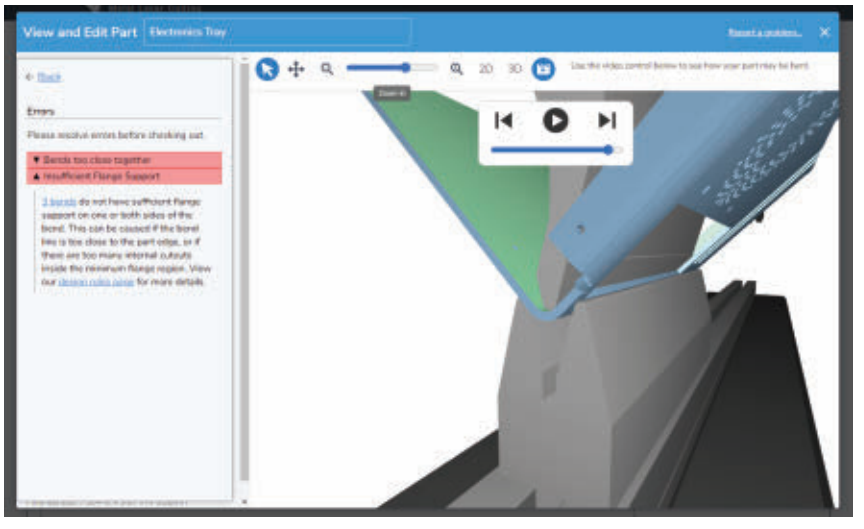
The software's nesting functionality, which is processor-intensive, has guided the company's server structure. OSH Cut uses servers in Utah and California, as well as distributed servers through Amazon Web Services. But its nesting server is in-house. "Our nesting server can do about 36 different nesting jobs simultaneously," Chamberlain said. "And it usually spends about 10 seconds on each one."

The company built the customer experience around these processing requirements. The system does a "first pass" quote without full nesting applied. If the customer hits "continue," it applies a "nesting discount" to develop the final quote. This subtle gatekeeping mechanism prevents the quoting engine from being utterly overwhelmed by performing a full nest for those who have no intention of buying, slowing the ordering process for everyone else.

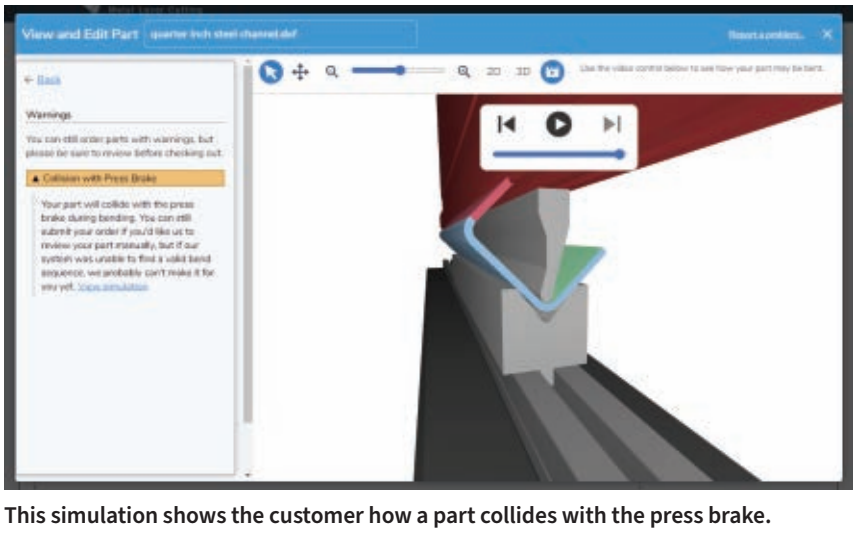
The system also has bending DFM, with software performing a full bend simulation during quoting. It checks flange lengths, cutouts close to bend lines, and other potential problem areas. Next it performs the bend calculations (using the applicable k-factor for the bend allowance and the needed bend deduction from the blank size), then assigns tools the shop has to achieve the needed inside radius. To speed processing time, the system starts with a folded part first and works backward. If the fully formed part doesn't collide with the punch or die, there's less (but not a zero) chance collision will be an issue earlier in the bend sequence.

"If the software finds a collision with tooling, it will tell the customer, who can click on the web interface to view an animation of the bend simulation," Chamberlain said. "They're told the part won't work and they see why. So, without even talking to a person, they can go back, modify their design, upload the part again, and watch to see if it will bend properly."

Once a job has been nested and (if required) simulated to verify the bending process, the quoting engine incorporates the material prices (based only on the material the job uses, not an entire sheet) and produces a quote, which goes into the customer's shopping cart, just like an Amazon transaction. If the customer wants to move forward, he simply checks out (again, just like he would on Amazon), at which point the automated scheduler springs into action.



Every quote requiring forming makes use of a custom-built bend simulation that checks for collisions and bend sequence issues. This simulation notifies the customer of insufficient flange support and tool access issues from bends being too close together.



This simulation shows the customer how a part collides with the press brake.

The scheduler operates via a pull-type system that maintains a set buffer of work-in-process between operations. Real-time monitoring ensures buffers stay within defined minimums and maximums. Go below the minimum, and you risk starving a process downstream; go above the maximum, and you risk overwhelming the operation and adding lead time.

"There are thousands of moving parts in our production planner," Chamberlain said. "It's complicated, but at the end of the day, we use the system to ensure we don't overwhelm any process and that we don't starve any process. And on the front end, the quoting engine itself gates incoming orders and selected lead time." This constant (and automated) communication between quoting and production planning is designed to ensure OSH Cut never promises a due date it can't meet.

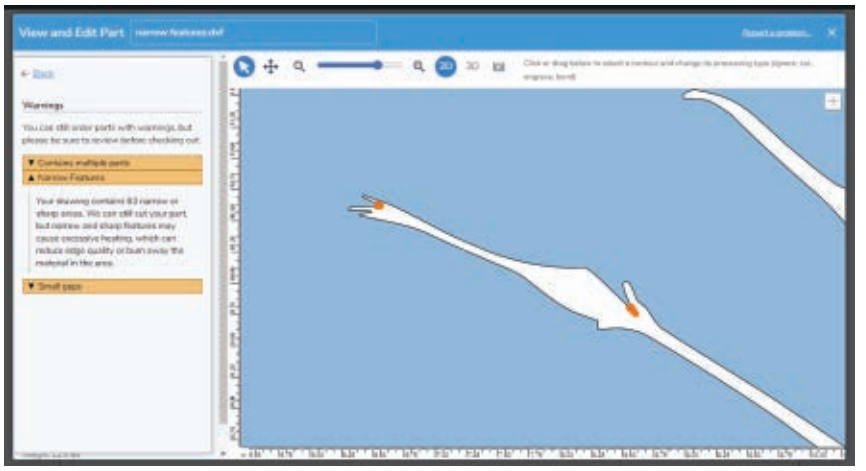
The automated pricing engine also ensures that margins stay within a certain target. "Honestly, because we set these target margins, and we never go below them, it means we don't win giant production jobs," Chamberlain said. "And that's OK."

The order then appears on a screen on the shop floor. "Here, we do have a little manual intervention," Chamberlain said. "Programmers see a list of parts and due dates, and they decide which jobs to add to a nest."

The nesting engine in quoting groups parts of a single job together. The programmer at the laser then can take these as is and group them as needed onto a sheet, reorient parts if needed, or adjust lead-ins and lead-outs for better process stability or to mitigate the chance of part tip-ups.

Adjustments might be necessary, especially if the job is grouped with other jobs on the same sheet—but again, because of its short lead times, the shop





OSH Cut's online quoting and nesting engine detects problem areas, including tight corners susceptible to heat buildup.

usually can't wait for additional jobs to fill a sheet. In fact, OSH Cut might nest a handful or even just a single part on a sheet of oddball material, then remove, label, and store the remnant. Because of the fabricator's streamlined remnant management, careful capacity control, and (especially) automated order processing, such oddball orders don't throw a wrench into overall part flow.

The laser programmer works with software built in-house that can nest and postprocess numerical code directly to the machine. It's a unified platform that effectively guides the customer experience online and transitions seamlessly to the shop floor.

The company launched its bending service in November 2020, and at present it sends a bend definition file directly to the brake's OEM software. But in the near future, Chamberlain said he hopes to develop software that can postprocess code directly to the machine. His goal is to create a unified platform that manages the entire process chain, from the customer-facing web portal to the machine tool itself.

Chamberlain clarified that, as the process stands now, the chain of events between quoting and that first cut and first bend is largely automated, but some manual elements remain. "It's true that we don't have any dedicated programmers. Laser programming is quick and easy enough, so all of our operators can do it. And our system automatically generates lead-ins, micro-joints, and nests based on part geometry. The results usually don't require modification. All the file prep usually required for bending is also handled by our system.

"But we still do program the lasers and the brake. It's fast, but orders do not go from order placement to production without some hands-on work … That's the gold standard, but we aren't quite there yet."

The Long-tail Potential

Several years ago I observed employees in a break room enjoying each other's company and, on occasion, looking up toward several big-screen TVs with maps showing the location of delivery trucks. I was visiting 247 TailorSteel, a massive on-demand fabricator based in the Netherlands with additional plants in Germany. At the time the fabricator had more than 50 laser cutting systems, dozens of automatic-tool-change press brakes, as well as a collection of automated guided vehicles that carried work between processes.

"At this point we have about 150 tons of steel coming in every day, and the next day it's all gone. Altogether, we have more than 4,500 customers." So said Carel van Sorgen, 247 TailorSteel president, during an interview at the EuroBLECH show in 2018.

247 TailorSteel found a way to scale up serving the long tail of low-volume work—and in that company's case, fully automated order processing was key. Like at OSH Cut, customers of 247 TailorSteel can upload a part and, through a quoting and order processing engine the company calls Sophia (named after van Sorgen's oldest daughter), receive an instant quote. Once a customer clicks "order," the part is nested and sent to the laser, all within minutes. When I visited the operation in 2017, the front office had only two employees handling the occasional service calls and managing certain credit checks. Everything else happened automatically online. At the time the company had annual sales of 50 million euros.

The European fabrication landscape is different, both culturally and geographically. With shorter distances between fabricators and customers, fabricators deliver extremely small lot sizes at frequent intervals. 247 TailorSteel's delivery trucks, with locations shown in real time in that well-decorated employee break room, make small delivery after small delivery: five parts here, 12 parts there.

But there are common threads. Both Europe and the U.S. have demand for low-volume production. European demand is geographically concentrated, so 247 TailorSteel's vast fleet of delivery trucks make business sense. In the U.S., the long-tail demand is spread across the entire country. In fact, 90% of demand for OSH Cut's services come from outside Utah.

"Shipping is one of our biggest operations," Chamberlain said, adding that the majority of the shop's employees work in that area, following a strict inspection and well-defined packing process. "We identify parts, wrap them together, put a label on them, scan those labels, place the parts in boxes, print the shipping label, and ship it out."

Scanning the parts helps track when the parts leave, adding a final data point in every job's order-to-ship timeline. The whole process looks very much like 247 TailorSteel's shipping process, only the packages are being sent hundreds and sometimes thousands of miles away, using UPS and the USPS instead of delivery trucks.

Of all OSH Cut's processes, final inspection and shipping are the most labor-intensive. To that end, the company has written detailed procedures that include everything from the kind of filler material certain parts need to the kinds of corrugated boxes to stock.

Software undergirds everything. And because company leaders wrote it all from the ground up, they can also improve it quickly. McKay and another developer on the team wrote most of the customer-facing code governing what the customer sees on the website, while Chamberlain wrote most of the production software.

"It's nice to be able to walk to the shop floor, notice there's a problem, then walk back to the office and take several days to write a software fix," Chamberlain said. "Within days, we see our processes improve."

At the same time OSH Cut faces similar hiring challenges as most fab shops in the industry. The problem might even be more acute, considering software allows automated operations to scale up so seamlessly. An automated front office can open the tap to more and more work, but that will require additional people. Parts can't pack and ship themselves.

"Now we're looking at how scalable we can be in terms of people," Chamberlain said. "How do we hire 50 people this year, keep the right culture, and maintain quality? That's going to be the challenge of 2021."

At this writing, the fabricator offers only cutting and bending, but Chamberlain said he hopes to add edge deburring and powder coating soon—again, all integrated within the company's automated quoting and order processing software. This might open the door to an even greater portion of the long-tail market.

"In 10 years shops that can't be responsive are going to have a really hard time," Chamberlain said. "We're entering a new world. The Amazon generation, those who can't remember a time before the internet, has grown up. They're young adults now, and they're entering the industry. A new, quick-response model has to drive the customer experience."

Senior Editor Tim Heston can be reached at timh@thefabricator.com.

OSH Cut, www.oshcut.com

247 TailorSteel, www.247tailorsteel.com

Mazak Optonics, www.mazakoptonics.com

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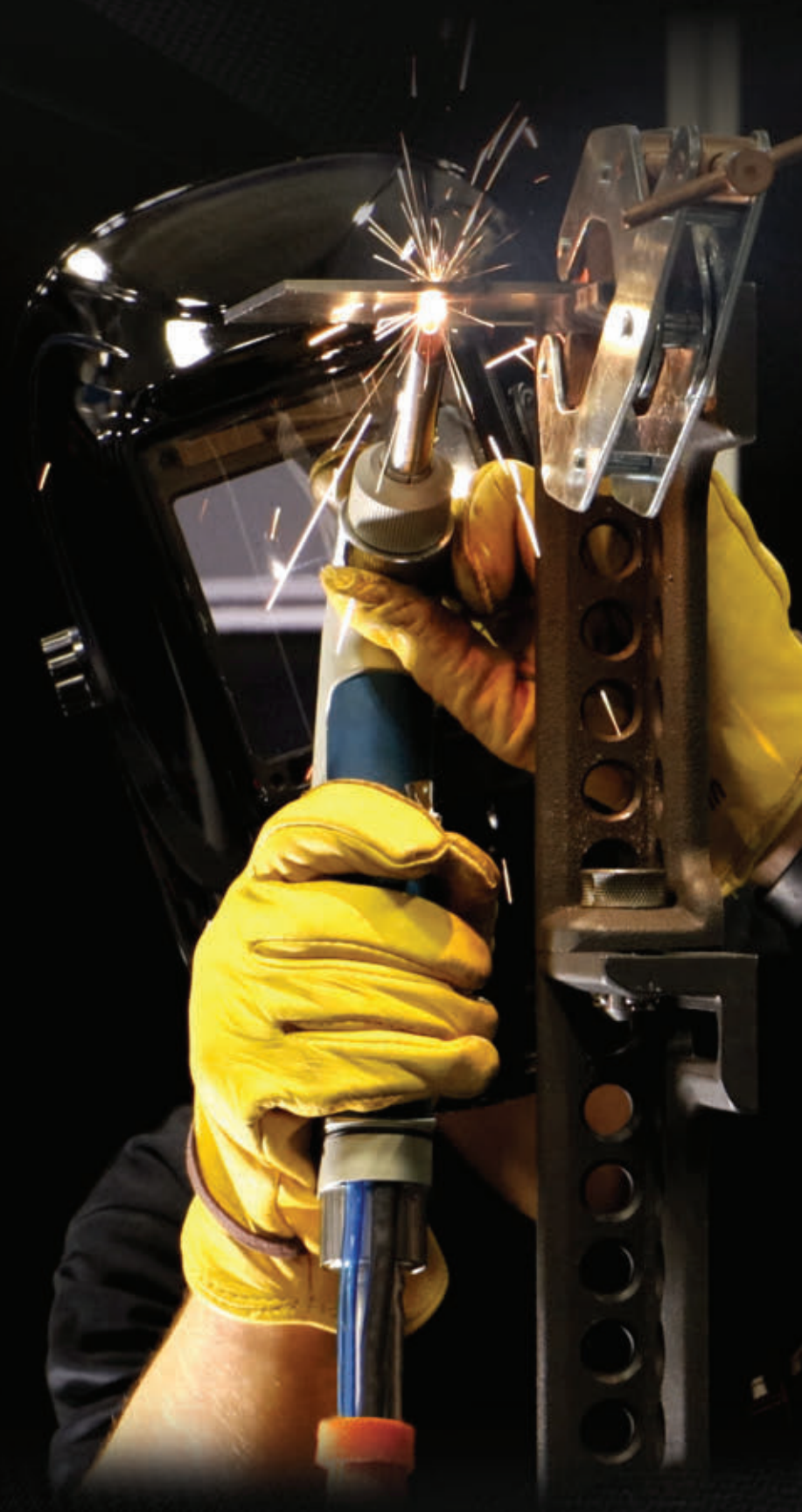
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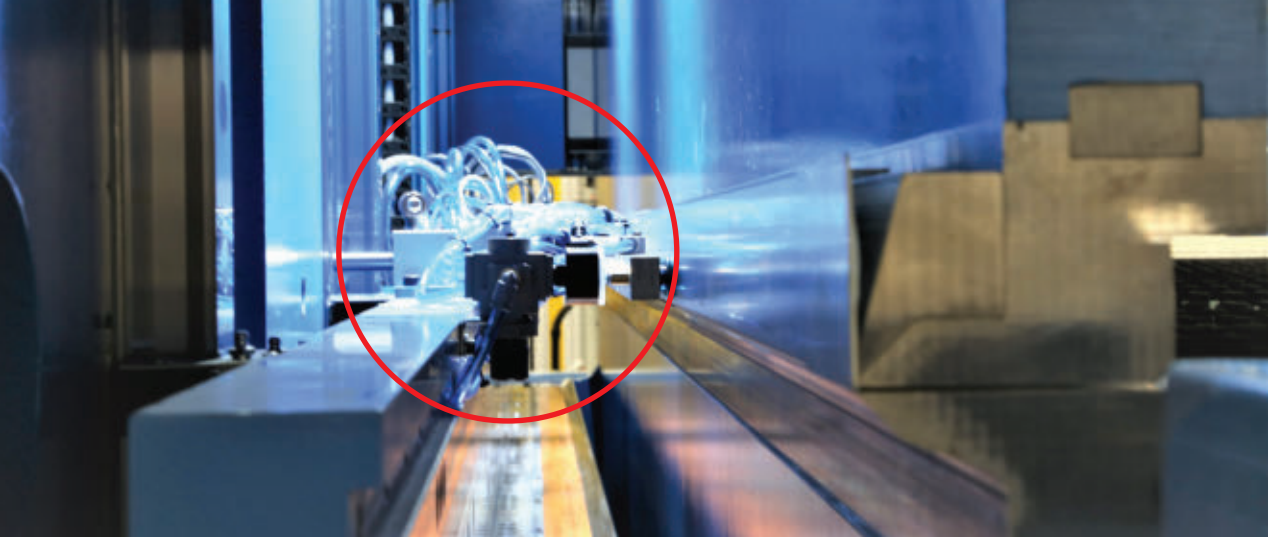


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A special manipulator mounted in the back of the panel bending machine can be fitted with either magnets or suction cups to assist the processing of long and narrow channel-type parts. The manipulator is circled.

Panel bending

helps open operational bottlenecks

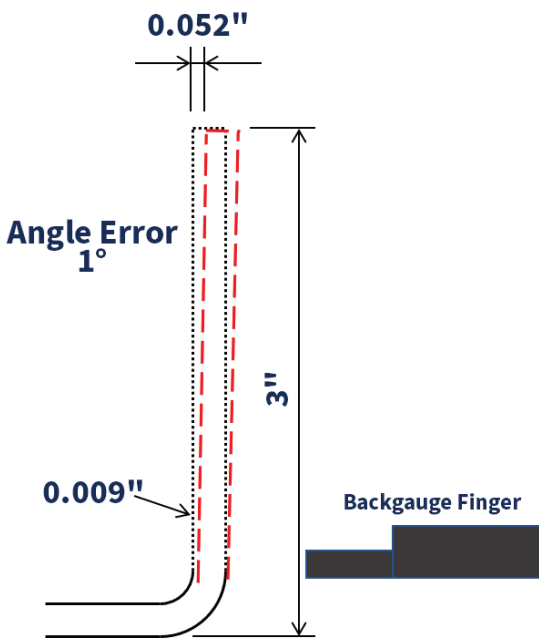
Multitool upgrade gains productivity in leaps and bends

By Jamie Sims

As is commonly known in the sheet metal fabrication industry, the bending operation typically represents a bottleneck in the production process. Panel bending technology can be useful in helping metal fabricators streamline this process while significantly increasing manufacturing capacity and velocity. The ROI for a panel bender can be quick when the application and annual usage for the part mix are a good match.

How Does a Panel Bender Work?

To gain a better understanding of the technology, it is important to note that panel benders work on an entirely different principle than press brakes. The speed of a panel bender is based on how the technology works.



The tolerance between two features of a part depends on the number of controlling dimensions. As this number increases, the tolerance accumulation tends to increase. A press brake operator gauging from a flange that is only 1 degree open causes dimensional errors for the next bend in sequence.

The part remains stationary while the bending tool forms flanges both up and down. The part then is rotated as the machine continues through the bending process for all sides, allowing for a very efficient bending process averaging four to five seconds per bend. Typically enclosure and flat panel parts are an excellent fit for panel benders. Large parts that are difficult to handle on a press brake can be especially good applications as well.

How Can Panel Bending Increase Bending Capacity and Speed?

It is generally agreed that the average setup time on a press brake is 15 to 30 minutes, which explains the push for automatic tool changeover systems that many press brake OEMs now offer. In fact, the setup time can be so excessive that fabricators will overproduce just to amortize the setup back into the production run. Unfortunately, the parts that are not needed right away can end up sitting around somewhere as inventory, work-in-process (WIP), or worse yet, get lost or thrown away by mistake.

Setup on a panel bender is much quicker because a panel bender can use common tooling to process a variety of part geometries and material thicknesses. The operator is not required to exchange tooling physically when going from one job to another. Setup for the next job simply involves sliding the clamping tools to the new positions as needed. This can be done manually, which takes about five minutes, or with an automatic tool changer, which further decreases the setup to about 90 seconds. Also, a panel's long and short sides can be processed simultaneously.

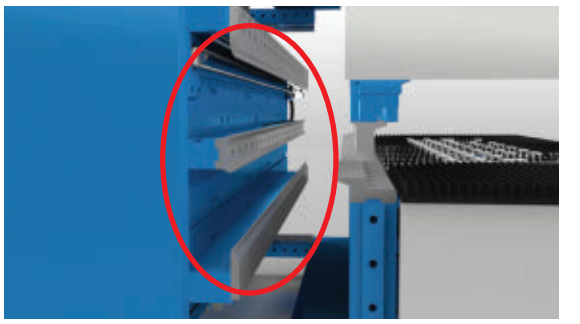
The reduction in setup time that a panel bender provides is advantageous for fabricators that wish to embrace the principles of lean manufacturing—making only what they need when they need it and reducing WIP.

Panel bending technology works according to the transfer line principle, so that parts are always moving ahead as different stations work simultaneously. By using a modular approach, fabricators can combine multiple bending units to reduce the bending cycle time further.

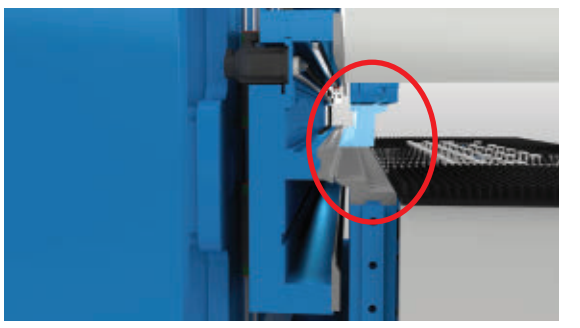
This method is especially useful for achieving a 1-1 ratio between the blanking and bending operations. Once a balanced ratio is achieved, the blanking and bending processes can be integrated into one complete line without one machine or process waiting on the other. The entire process can be further optimized by feeding the finished parts directly to the assembly area, eliminating additional handling and WIP.

How Can More Part Geometries Be Processed?

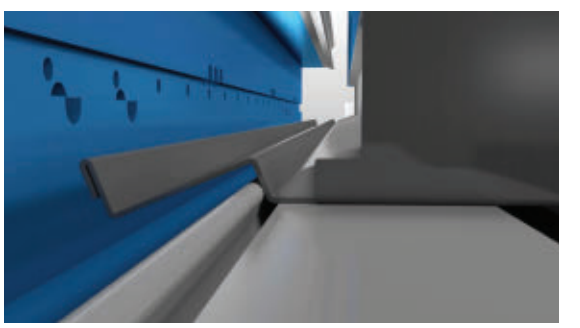
As with all technologies, panel bending has some caveats to its advantages. Many fabricators get excited about adding this technology to their operation only to find they do not have the right mix of parts to keep such an efficient machine busy. In many cases, complex part geometries or narrow parts can be a misfit for panel bending if the machine cannot process these types of parts with the



A multitool console can use several bending tool profiles.



In a panel bender, the part remains stationary while the bending tool forms flanges both up and down. The part then is rotated as the machine continues through the bending process for all sides. Upper and lower segmented clamping tooling is shown.



The bending tool uses interpolated movement in the X and Y axes for a single point of contact during the bending process to reduce marring and scratching.

common tooling and manipulator concept that the machine design is based on.

The idea behind the multitool panel bender was inspired by relentless research on how to expand the capability so that more types of part geometries could be processed to completion without additional manual tooling changeover.

A console is incorporated into the multitool panel bender's design so that it can accommodate multiple bending tools. This enables it to bend intricate part profiles that previously were not good candidates for panel bending. An additional manipulator device on the backside of the multitool panel bender allows fabricators to process narrow channel-type parts that had been considered a challenge for traditional panel bending.

The multitool panel bender works with mild steel sheet thicknesses from 0.020 to 0.118 in. and lengths up to 13 ft. for a single machine and up to 26 ft. with two machines in tandem.

Additional features such as moving tools, visual inspection devices, grippers, and custom tools can be incorporated into the final system.

The multitool panel bender is designed to be simple to program, control, and maintain, all while powered using electric drives for low energy consumption.

How Can Panel Bending Streamline the Entire Process?

It is important to note that panel bending addresses not only the bending bottleneck but downstream operations as well. An analysis of the different processes in an average sheet metal fabrication shop shows that welding and assembly are by far the most expensive processes on the shop floor, with one of the main culprits being poor fit-up. How much time does the welding operator have to spend trying to make the part fit in the welding fixture rather than weld? How often does the assembly operator struggle to get the parts to fit together? This happens more often than not.

Panel benders can help streamline these downstream operations by producing parts with high flatness and accuracy. Superior flatness is achieved because unlike a press brake with dynamic crowning, minimal tonnage is placed across the bending line.

Accuracy improvements are attributable to how the part is referenced. It is referenced from a single datum point, eliminating what is known as tolerance error accumulation. When making multiple bends on a press brake, the operator often is required to gauge from previously bent flanges. This opens the opportunity for the tolerance error to accumulate, leaving the welding or assembly operator as the last line of defense to correct the problem. A quick overview of the welding and assembly departments is a good place to start when evaluating the bending process.

When Is a Panel Bender a Good Fit?

Panel benders are a good fit for large, boxy, flat, straight, and rectangular parts that are difficult to bend and handle by a single person using a press brake or when dealing with highly cosmetic parts.

Panel bending is commonly used to form:

- Appliances such as refrigerators.
- Construction components such as panels, doors, elevators, cable trays, platforms, and profiles.
- Electrical appliances such as electric cabinets and lighting.
- HVAC equipment.
- Metal furniture for commercial kitchens, offices, storage, and lockers.
- Truck trailers.

Panel bending is especially applicable for bending cosmetic, or appearance, parts. Supported by a brush table underneath, the bending tool's interpolated movement in the X and Y axes maintains a single point of contact to the flange during the bending process, thereby reducing scratching and marring.

Panel bending technology offers many benefits in modern sheet metal manufacturing. While panel benders have some limitations in the types of parts they can process, they can be an efficient bending method when the application fits.

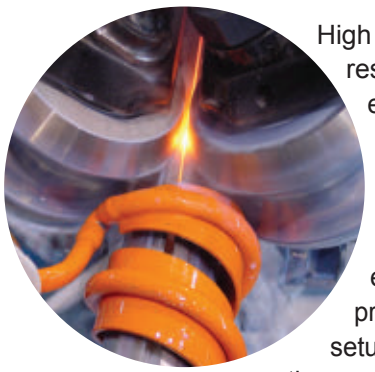
Jamie Sims is general manager for Ursviken Inc., 1636 Todd Farm Drive, Elgin, IL 60123, 847-214-8700, sales@ursviken.com, www.ursviken.com.

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A Path for a Better HF Weld

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High frequency welding is a type of electric resistance welding in which metal strip edges are heated using induced current and then forged together during a roll forming process to create a continuous seam weld. The HF welding process relies on key process parameters such as welder power, frequency, precise heat input, raw material, and mill setup. With advancements in steelmaking, the process window for achieving a successful HF weld becomes smaller making it important to closely control and monitor process parameters. This presentation summarizes the effects of HF welding parameters and mill setup and describes how to reduce costly scrap while achieving a better weld by optimization of process parameters.



YOU'LL HEAR FROM:

Olexandra (Sasha) Tupalo
Materials Engineer
Thermatool Corp.

Sasha received her Bachelor of Science from Prydniprovsk State Academy of Civil Engineering and Architecture (PSACEA) in Materials Engineering. Furthering her study, she received her Master of Science in Materials Science and Engineering at the Worcester Polytechnic Institute. Sasha joined Thermatool Corp where she manages Thermatool Labs and is deeply involved in scientific research involving induction solid-state welding, heating process development, and quality assessment for tube and pipe producers around the world. She is a member of numerous scientific and technical committees such as ASM, ASTM (A01, E04 and E28), TMS and WAG (Welding Advisory Group) at AISI. Her work includes delivering dozens of training classes relating to induction welding, heating and quenching technologies. In 2019, Sasha was recognized by *Heat Treat Today*'s 40 Under 40: Class of 2019.

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Tink Inc.'s roll-out buckets are designed to add dump height and reach to any wheel loading machine. With this type of bucket, the loader can reach over the 13-ft., 6-in. sides typical of most high-side trailers. (From left) Nathan Brown (ARKU sales engineer), Hank DuBose (Tink vice president), and Allen Kinyon (Tink operations manager) talk about the company's buckets. *ARKU Inc.*

The deburred and edge-rounded bucket challenge

Tink Inc., Durham, Calif., ditches manual deburring of parts for its heavy-duty industrial products

By Dan Davis

Working with heavy-duty materials is hard work—for both man and machine.

Tink Inc., Durham, Calif., lives that experience each day. The company's fabricators and welders work with abrasion-resistant plate like AR 400 to build front-loader buckets and mobile home material handling equipment that are able to do the tasks they were designed to do while also standing up to the rigors of the job. The minimum steel thickness that the fabricating company works with is 0.25 in., and some of the parts reach 3 in. thick. These buckets and mobile home lifts are robust by design and heavy-duty performers in action.

"Our customers don't want any low-quality clamps, buckets, or lifts. They want longer-lasting products that allow them to carry out the demanding tasks for as long as possible," said Hank DuBose, the company owner.

Tink Inc. plasma-cuts the thick and dense material and welds the parts to create the buckets and lift products for its customers. The products then are painted before being sent to the customer.

Grinding is a key element of this production process. The parts need to have burrs and slag removed before welding. Also, rounded edges on the parts help the paint adhere to the metal surface better.

DuBose said the company needed to "ramp up" its grinding efforts because it was not nearly as efficient as other parts of the manufacturing process. At any one time, the company could have five to 10 people manually grinding parts.

"We were having a hard time filling those positions and keeping guys there," DuBose said. "It's an entry-level position, so we had a high turnover rate. It's also physically demanding."

He added that because a lot of the people involved in deburring parts are new to metal fabricating and they are engaging in a physically demanding activity over an entire shift, they run a greater risk of injury than their more experienced colleagues. Manually deburring the dense material with a 6-in. grinder is a tedious task to begin with, but over several hours a person might let their guard down, resulting in an injury. DuBose said most of the company's foreign-object injuries, related to sparks or pieces of metal coming off during the grinding process, occur in this department.

DuBose knew that automated deburring could greatly help the situation—boosting output and being able to deliver more consistent results, grind after grind. He just didn't know exactly where to start.

How It All Started

Before DuBose's father and uncle started Tink Inc., they ran a construction equipment rental company in the 1970s. One day a customer came to the business looking to rent an attachment for his skid steer loader and commented that he'd actually consider buying one if manufacturers produced better attachments for loaders. The two business owners recognized that OEMs were failing to meet customer demands, so they decided to make bucket attachments with customer specifications not available in the market at the time. That led to DuBose's uncle and father founding Tink Inc. and designing its first high-dump bucket for skid steer loaders. The customer bought it, and others soon followed.

That success was followed later by a request from another customer looking to improve the design and fabrication of his Translift mobile home moving equipment. Familiar with the material and fabricating skills used to create heavy-duty construction equipment, Tink Inc. applied the same thinking to the redesigned Translift product. The result was a product embraced by the mobile home industry, which was looking for a device that could carry modular sections or entire mobile homes and operate properly while supporting the tremendous weights.



Tink Inc. cuts a lot of plate in the manufacture of its roll-out buckets and mobile home lifting devices. *Tink Inc.*



Kinyon, David Hernandez (Tink machine operator), and Brown inspect parts before they enter the deburring machine. *ARKU Inc.*

Today other companies, including one of the largest names in the industrial equipment space, have their own versions of high-side dump buckets. There also are other manufacturers of mobile home moving devices. But Tink Inc. remains a vibrant player in the space, employing 75 people, 25 of whom are welders, at its Northern California shop. DuBose said that he has been passionate about metal fabrication from a very early age and that he is constantly looking for ways to keep up with customers' changing priorities. The search for some sort of automated grinding technology was just the latest challenge.

Looking for a Better Way

DuBose found his answer attending a metal fabricating tradeshow in late 2018. Perusing an industry magazine, he came across an advertisement for ARKU promoting its automated deburring equipment. He noticed the company had a location in the Midwest, so he made a mental note to follow up with a visit to see the deburring technology in person.

The subsequent visit to ARKU's Cincinnati headquarters took place in February 2019. DuBose didn't have to check his test parts for the trip there; they were sent in advance to see how ARKU's Edgebreaker 4000 would handle them.

The actual demonstration proved that the machine was going to be the right fit for Tink Inc. It removed any burrs and slag and rounded off the edges of the plasma- and oxyfuel-cut parts from both sides in just a single pass.

"After seeing the results, it was obvious that the machine could handle heavy-duty plates and parts as well as regular sheet metal easily and reliably," DuBose said.

After returning home, DuBose consulted with his team and shared some videos of the Edgebreaker in action. "The team was convinced that the machine was a perfect match for us, so we ordered right away," he said.

Tink got its machine later in the fall. It came with infeed and exit conveyors and a wet dust extraction system that helps to keep the air free from dust that the deburring process generates.

DuBose said that operations training took place over several hours. He added that controls were "intuitive" and operators of nearby plasma and CNC mills quickly caught on. In fact, the operator only needs to input the thickness of the material into the control interface and ensure that the appropriate abrasives installed in the unit match the intended job. (The height of the material does not take into account any peaks associated with existing burrs; it's the true material thickness.)

Tink has gone from multiple people tackling the grinding job to one person operating the Edgebreaker, which processes about 90% of the parts that the company produces. (The machine can handle parts up to 4 in. thick and just under 51 in. wide.)

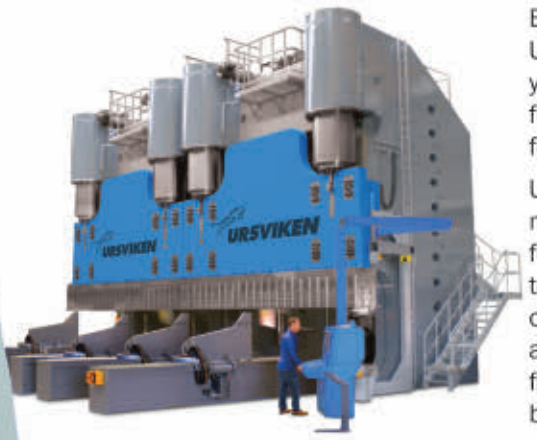
"It does a good job of getting everything off there," DuBose said. "We can adjust the settings so that we can just get the mill scale off the surface, which is more for the welding process than anything. Then there are other parts that need a more polished finish, and other parts where we want to be a little more aggressive. We have the ability to do all of that with this machine."

Editor-in-Chief Dan Davis can be reached at dand@thefabricator.com

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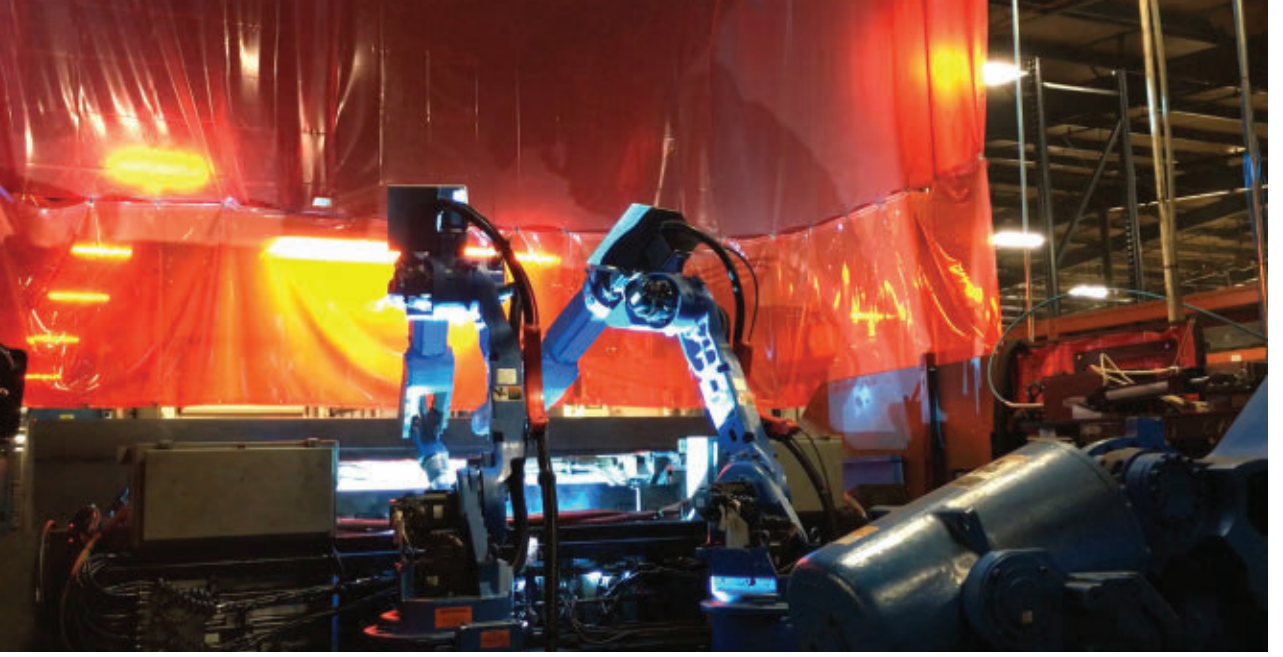


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How HS Metalworks is broadening its customer base

By Tim Heston

From the potential customer's perspective, what makes a metal manufacturing company not unusual, but unique? A mission statement might mention *stellar customer service, competitive pricing,* along with *high quality and delivery performance.* Others might say *our people set us apart. With us, it's not just a supplier-customer relationship, it's a partnership.*

Such attributes can build a successful company, but do they make a metal manufacturer unique? Competitors, deservedly or not, could make similar claims.

Having a proprietary product can indeed make a metal manufacturer unique. But most companies in metal manufacturing are contract operations or job shops. What exactly is their product? In one sense, their "product" is the mix of manufacturing capabilities they offer. If difficult for others to replicate, that technology mix really can make an operation unique and, hence, become a metal manufacturer's key competitive advantage. This in a nutshell describes HS Metalworks.

"Today we make everything from overhead garage door springs to school bus seats."

So said HS Metalworks President Tim Becker. The company offers not just laser cutting, sheet metal bending, and stamping, but also wire drawing and forming, tube production, and tube bending. Not bad, considering the organization's roots go back to a coiled seating spring.

A Little History

HS Metalworks is a division of Hickory Springs Manufacturing (HSM), a company with wide-ranging capabilities that its founder, Parks Underdown, probably couldn't have imagined. Underdown launched the company in 1944 to produce coiled seating springs, edge wire, and other coiled wire products for bedding and furniture. In the 1950s it began producing latex and polyurethane foam. Then in 1974 HSM entered the sheet metal and tube manufacturing market, introducing stamped and tubular components for sleeper sofas and similar products. In 1978 the company began drawing its own wire.

In 1982 HSM made its first (but certainly not its last) major acquisition, buying Spiller Spring Co. to expand its footprint in the bedding industry. The next year it purchased a plastics extrusion facility, expanding its vertical integration up the supply chain even further and gaining a foothold in the packaging market. In the 1990s the company began developing its own products, including a folding metal step for recreational vehicles.

In the 2000s and 2010s, HSM ramped up its acquisition strategy. In 2008 it acquired JSI Corp., a metal parts supplier for the RV industry, and in 2012 it purchased The C.E. White Co., a seating products manufacturer for commercial transit and school buses. Finally, in 2016, the company acquired Atlanta Attachment, a manufacturer of heavy-duty sewing machinery, packaging equipment, and other machines for the sewn product industry.

The next year HSM, which at that point had grown dramatically over the decades through multiple acquisitions, reorganized into six operating divisions: Hickory Springs, which makes the coiled furniture springs that started it all; Atlanta Attachment; HSM Diversified Products & Services, which makes PPE gowns, masks, and other health and sleep products; PTI, a foam manufacturer; HSM Transportation, a maker of seat cushion and safety belt restraints; and, finally, HS Metalworks. The entire organization employs several thousand people, and HS Metalworks—with five plants, the main one being in Hickory, N.C.—is today the largest division by far.

Climbing the Food Chain

HSM's story is about strategic expansion. The company began in the furniture industry, became vertically integrated to control more of its manufacturing, and found that with that control, it could offer different products and manufacturing services to sectors outside the furniture business. Doing so helps HS Metalworks, along with the entire Hickory Springs Manufacturing organization, diversify revenue.

HS Metalworks' capabilities can be boiled down to three main areas: wire, tube, and sheet metal. Spring wire, including those made of 1060 and 1080 high-carbon material, still makes up a large portion of HS Metalworks' revenue portfolio. It also manufactures a heat-treated high-carbon spring wire made with induction tempering. And it draws low-carbon wire that can be shaped (via CNC wire forming) and welded into a variety of wire forms, such as those used in shopping carts.



A coil-fed stamping line at HS Metalworks' Hickory, N.C., plant complements the company's laser cutting and press brake capacity, utilized for lower-volume jobs.





Another example of vertical integration, HS Metalworks produces its own tube and forms it into the required shape.

The company operates several tube manufacturing locations, one in Fort Smith, Ark., and another in Hickory, that not only bend tubes but make them as well. The organization has several electric resistance welding (ERW) mills that produce tube up to about 3 in. in diameter and down to about 0.75 in. dia. Finally, the company's sheet metal operation incorporates laser cutting, press brakes, and stamping. Supporting all of this are joining and finishing capabilities that include robotic arc welding, resistance welding, grid welding (for joining wire forms), flow drilling, powder coating, and wet paint.

Built up after years of acquisitions and organic growth, having all this capital-intensive in-house manufacturing would be a risky bet if the entire organization focused on one narrow sector, like home furnishing components. That's why over the years the company has developed products that serve complementary markets.

As Becker explained, "We've grown from our core product lines of wire, tubing, and stamping, and started climbing the food chain"—that is, finding supply chains that require similar yet distinct products in very different industries. "For example, we took our wire business," Becker said, "and rather than just focusing on supplying wire internally [for existing furniture and bedding products], we climbed the food chain and extended our product offering to include music wires; screen cloth-quality wires; and wires going into mechanical spring applications, like elevators and a variety of other equipment.

"We've done the same thing in tubing," Becker continued. "We have a department that fulfilled our furniture needs, like our tube mill that provided us with raw material used in sleepers for sofas. Now we sell more tubing for a variety of end uses, be it for firewood racks or trailer manufacturing or shopping carts."

By climbing the food chain, HS Metalworks uncovers opportunities in new markets that might require not just a specific part, but a *combination* of parts that use multiple processes. Becker described one subassembly the company supplies to the all-terrain-vehicle market that incorporates both stamped and tubular components joined via projection nut welding.

The Potential of Cross-Selling

It's no secret that small operations dominate the metal manufacturing business—and for good reason. Scaling up isn't easy.

Yes, OEMs want to simplify their supply chains. They might dual-source to reduce risk, but they don't want to weave together a complex supply chain involving dozens or hundreds of companies. Ideally, they'd prefer working with a handful of highly capable suppliers. That's the idea behind HS Metalworks' current structure: a one-stop-shop for sheet metal, tube, and wire, capable of incorporating all three into a finished subassembly. The unusual combination of processes sets the organization apart.

Still, Becker conceded that streamlining all the disparate parts of such a large organization isn't easy. "I'll be honest, we're learning. We're still relatively new at trying to mesh together what used to be completely independently run plants into one Metalworks division."

Scheduling is one challenge, as it is for many metal manufacturers, especially those with highly diverse product mixes. For several years Becker and his team have been working to coordinate production among HS Metalworks' five facilities. To streamline flow for many products, production managers treat the Hickory Springs plant as the "mother plant" where all components—sheet, tube, and wire—come together for final assembly and shipment. The schedule is managed partly through software and partly through manual, homegrown systems. "Those systems that we've built in-house have so far helped us meet our goals and our delivery schedules."

Another challenge involves the expertise required for truly effective cross-selling. Experts who focus on polyurethane foam, high-carbon spring wire, stamping, laser cutting, CNC wire forming, tube production and forming, spring components for bedding, and more all work under the Hickory Springs Manufacturing umbrella. The challenge is organizing that expertise for effective cross-selling.

"Within the Metalworks division, we're working with our wire, tubing, and [sheet metal] experts, and cross-training them between product lines within the division," Becker said. "Ultimately, we'll take that a step further and cross-train salespeople between divisions." For instance, bus-seating opportunities in HSM Transportation might lead to tube, sheet, or wire opportunities in HS Metalworks.

A Busy 2021

2020 was a unique year for many metal manufacturers, and HS Metalworks was no different. "We were above budget [early in the year], but then business fell by 42%. It was just crazy," Becker recalled. "Orders came back slowly, and by June and July we were back cooking fairly well." He added that fluctuations in raw material cost and availability presented additional challenges.

So how's 2021? "Surprisingly, it's been one of the busiest years I've ever seen," Becker said. "There's a lot of disposable income out there, and we feel there's pent-up demand. People are sitting at home, they look around, and they decide to fix up the place. They buy new furniture. They fix the garage. They put in a new patio. They spruce up the yard. That's all extremely good for us.

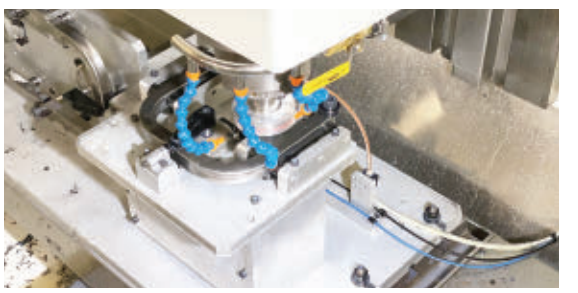
"As of right now, we've got our first quarter in the bag, and we're significantly ahead of budget. We're happy and proud to say that."

To sustain that growth, HS Metalworks will continue to sell its unique "product"—its mix of processes and expertise that separates it from the pack.

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HS Metalworks, www.hsmetalworks.com

Hickory Springs Manufacturing, www.hsmsolutions.com



A flow drill, operating with high pressure and frictional energy, creates a hole in a workpiece at HS Metalworks' Hickory plant.



Vertically integrated, HS Metalworks' wire capabilities include both drawing (pictured here) and forming.

Breathing new life into a big press brake

A control retrofit can bring an old piece of iron into the modern age of metal fabricating



Old iron is built to last. A new control system can help it last even longer.

By Tony Briner and Justin Atkins

A large press brake is a testament to metal fabricating's might. These giant bending machines take on workpieces measured in fractions of an inch or even more than an inch. A lot of the work processed on these powerful devices requires multiple operators to complete the task. They are big pieces of equipment for big jobs.

A fab shop's need for a powerful bending tool has always been a constant. That's why you see vintage press brakes of 1,000 tons or more still in operation on shop floors. If these bending behemoths have been maintained according to the manufacturer's specifications, they still can deliver the same forming power they were designed to produce when they were installed decades before.

As any metal fabricator knows, however, there's always room for improvement. If that large press brake was installed within the last 30 years, it might be a candidate for modernization. A modern control upgrade can bring modern conveniences and benefits to a brake that already has the brawn.

In fact, press brakes from 350 tons and up are very good candidates for control upgrades because this type of retrofit is much more cost-effective than replacing the older brake with a new one. Smaller-tonnage press brakes aren't as expensive, so the return on investment for a control upgrade for them isn't as clear.

Cincinnati Incorporated faced this situation a couple of years ago with its 1,500-ton, 26-ft.-wide press brake. That giant was first installed in 1989.

Background on the Big Brake

The company uses the 1,500-ton press brake primarily to straighten plates that have been cut on the plasma cutting table. (The thermal energy introduces some distortion to the plate surface, and it needs to be flattened before it continues on to machining and welding.) The plate, which can get as thick 1 in., is fed through the center of the bending window, where the powerful ram taps the steel back into a flat state.

The brake also is used for precision bending, including a piece of 0.75-in., 22-ft.-long plate that needs to be within ±3 degrees of the specified bend angle—a pretty impressive feat for such a big part. In many instances, fab shops struggle with parts that large.

Accuracy is a main reason that metal fabricators should consider upgrading their large press brakes to the latest control technology. Cincinnati Incorporated shared that same desire, but modernizing the large press brake also gave the company the chance to formally work out an upgrade path from the old control technology to the latest PC version. Once that upgrade proved successful, the engineering team could reach out to the user base and offer the same modernization path for their large press brakes. If those fabricators keep their machines tuned up and lined up, they should be able to make good parts.

What else is a modern press brake control going to offer owners of a high-tonnage press brake? The shop is going to get the latest PC version of the control software, which brings all of the firewall protection that will keep the IT staff happy. (Show IT specialists a 10-year-old control and watch them cringe.) An upgrade brings the control software closer to what is being used on a shop's other press brakes, which means that operators can fill in for each other on different brakes without wasting time trying to get used to a different type of machine control. In some instances, an upgrade means that a fabricator can finally program offline and actually store bending jobs, eliminating the need for a programmer or an engineer to recreate the job instructions each time the part is to be made.

The Retrofit Process

Cincinnati understood the benefits of upgrading the 1,500-ton press brake, but before any upgrade could begin, the team had to determine what needed to be done.

For any metal fabricator, the first step in the retrofit process is to run the machine to make note of any deficiencies. If the brake is underperforming in terms of accuracy, a technician can start troubleshooting to see if it is a control or a mechanical issue. The metal fabricator then can decide how to correct the situation.

After seeing what the brake can do, the fabricator needs to determine if it wants the brake to be able to do more. A very basic changeover to a standard PC control is possible. This provides real-time control over the bending action and some job storage.

More complex upgrades can provide for control over not only bending, but multiaxis backgauges, sheet supports, safety mechanisms, and angle measurement. The PC-based upgrades also open the door to networking, offline programming, and the ability to store jobs.

The Cincinnati team determined that a basic upgrade to the latest PC offering made sense because of the type of work the brake was mostly used for. Advanced features, such as angle measurement, aren't yet available for these large machines, so a more basic offering made sense.

The manufacturer also updated the backgauge. This wasn't a simple replacement of amplifiers, which are the components that will wear in a backgauge over time. This retrofit includes amplifier upgrades, new encoders, and new motors. Now there's no doubt that the backgauge is on time and in position for the bend with the new digital control.

The large press brake had a rear plate support with rollers that also had to be addressed with the control upgrade. The support system was being looked at as a possible addition to the standard press

brake design for other large Cincinnati press brakes when it was added several years ago, but that new feature was never commercialized. Nonetheless, the control did need to address those supports as well.

A new control can deliver accuracy only if the information provided to it is accurate. If a new tooling library is part of the new control package, a fabricator needs to know the actual dimensions of the tooling being used. Accurate dimensions help to turn expectations of accurate bending results into reality.

As part of this investment in the high-tonnage press brake, the company also invested in new precision-ground tooling, which has made a world of difference in delivering accurate bending results. It also forced the forming department to take a look at older tooling made by craftsmen over the years; gather the tooling's actual dimensions; and do some maintenance, such as repairing a punch that may have lost the radius on its nose.

The End Result

As part of this entire upgrade process, Cincinnati also removed the ram from the machine and remachined the clamp to deliver a greater degree of parallelism. Now the brake has a parallel spec that is ±0.007 in. across the entire width.

Today the press brake is operating more efficiently than before the upgrade and producing more accurate parts. The bending department also has found a new level of productivity, with operators moving easily from one brake to another now that all the machines are using the same control technology.

With the introduction of some more complex parts, the bending department has re-established the practice of programming all the press brakes offline. The company had gotten away from that because, frankly, some of the operators were so efficient in using the old control technology to program the jobs that an engineer wasn't needed to do the work offline. The introduction of the new control on the press brake provided an opportunity to take programming off the shop floor. This let the operators focus on bending, and the results are a tighter process and better parts.

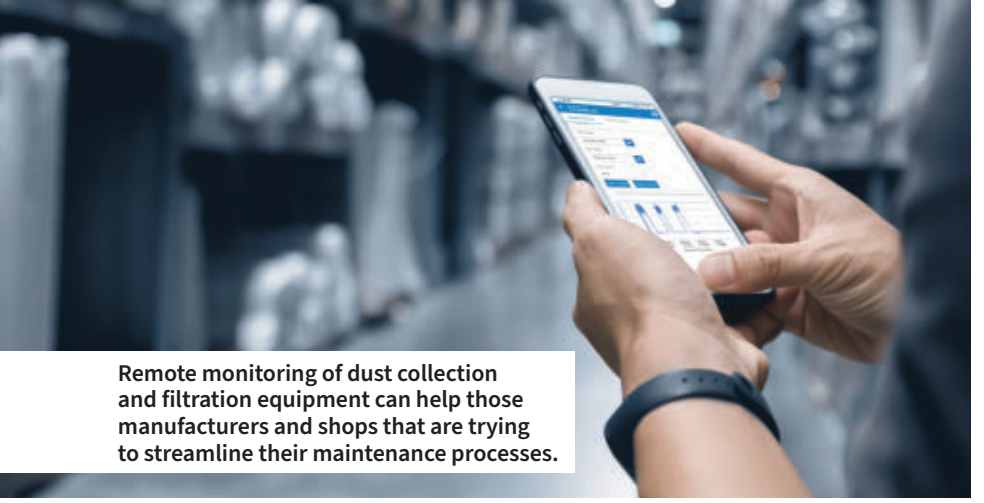
A timely press brake upgrade, new tooling, and a more streamlined approach to programming and part production have resulted in positive results for Cincinnati. And it all started with that reliable piece of iron. It's the same as the farmer with the 1960s-era John Deere tractor who decides that he wants to introduce a fuel injection system to it and replace the seat and steering wheel. That farmer can expect to be riding that tractor in the field for years down the road.

That retrofit package also is a foundation for another round of upgrades should the fabricator decide to add new features, such as a laser safety curtain. The latest control technology provides more opportunity for quick and easy feature additions in the future.

All in all, giving new life to an old brake might make sense for many fab shops. The three or five days it takes to follow through on such an upgrade is time well spent.

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Remote monitoring of dust collection and filtration equipment can help those manufacturers and shops that are trying to streamline their maintenance processes.

The internet of things comes to industrial air filtration

Digital connectivity means always knowing how dust collection systems are operating

By Brent Nelson

The popular saying "If it ain't broke, don't fix it" seems to be the approach many companies are taking for their maintenance needs today. Of course, the majority do not wait until their equipment requires unplanned attention. Many are deploying preventive maintenance strategies, and an increasing number are going a step further by using remote equipment monitoring and performance data collection to better understand real-time system conditions.

This approach is more commonly referred to as condition-based maintenance (CBM), a strategy that uses indicators to flag decreasing equipment performance issues in real time for busy plant maintenance teams. With CBM, maintenance is performed only when the data shows that performance is decreasing, or if a critical maintenance action is needed, helping maintenance teams save time by eliminating some in-person review steps on the collector. In contrast, preventive maintenance kicks in only at predetermined, specified intervals, which means manufacturers might not discover problems at the moment they occur or may be acting before it is necessary.

CBM also can be more effective than preventive maintenance in avoiding unplanned repairs and downtime. The aging workforce, along with recent production slowdowns, distribution delays, and staffing shortages because of the pandemic, have accelerated the push for CBM, which has become a standard practice in recent years across many industrial environments to manage operational costs and prioritize staff time. Increasingly, however, manufacturers also are discovering additional benefits of connected monitoring services.

Remote Monitoring for Dust Collection

Dust collection plays an important supporting role in any manufacturing business, and for the metal fabrication industry in particular. And fabricators know all too well that monitoring a dust collection system usually means reading instrument panels, then recording the data manually and interpreting it. These are time-consuming tasks that might not provide all the information you need to make timely decisions. Data recorded manually only reflects a point in time, but connected monitoring is continuous, letting you see trends and spot deviations that are helpful for all stakeholder departments—operations; maintenance; and environmental, health, and safety (EHS).

A remote filtration monitoring service helps manage particulates in the air and stands apart from traditional filtration control systems because it relies on Internet of things (IoT) technology to connect to a plant's filtration system and monitor its performance. Thanks to IoT, this service gives manufacturers continuous visibility into their filtration operations, helping them better manage important processes that support primary manufacturing activities. The ultimate goal is to run without unplanned interruption, while simultaneously helping to manage compliance requirements.

Remote monitoring is an attractive option for facility teams looking to streamline their work flow and maintenance processes, optimize procedures to support EHS initiatives, and gain more valuable data and insights to help them stay ahead of potential challenges.

A 2020 survey of plant engineers and maintenance managers conducted by Donaldson confirms the need for reliable remote filtration monitoring services. More than half (56%) of respondents saw dust collection as critical to process, and 49% reported seeing a line shutdown based on a collector stoppage. Meanwhile, 60% of respondents reported facing at least one collector downtime event per year, while 14% said they faced at least one per month.

The good news is that remote filtration monitoring can become a natural part of a plant's CBM process and overall crisis management plan. Here are three specific reasons manufacturers and job shops should consider adopting CBM and a connected filtration monitoring system across their operations:

1. Do more with less.

Amid staffing disruptions related to quarantine periods, furloughs, and downsizing, many organizations have had to put a freeze on hiring additional maintenance managers and technicians during the last year. During these lean times, relying on remote monitoring systems to keep tabs on machines like dust collectors makes sense.

With CBM, you can significantly reduce the need for in-person inspections of your dust collectors, which frankly aren't that good at preventing unplanned downtime anyway. CBM allows you to deploy your teams where and when they are needed and avoid unnecessary checks and physical walkarounds to record data points.



A technician connects a compact box on a facility dust collector to set up iCue, Donaldson's remote filtration monitoring system. This device provides the means for the maintenance team to monitor the collector's performance at all times.



Dust collectors are important tools for keeping shop floor workers safe. The collectors, such as the one attached to this laser cutting machine, filter fine particulates out of the air, creating a safer work environment.

For CBM, maintenance teams frequently use monitoring services that provide reliable and accurate data through a dashboard and receive timely notifications that flag maintenance tasks that may be coming or those that need immediate attention.

This approach to maintenance is not theoretical. For example, after a six-month trial period using a remote filtration monitoring service, a large industrial mineral plant in the southern U.S. anticipated it would slash its preventive maintenance time on its 23 dust collectors by roughly 900 hours per year. Now the plant's workers have more time to devote to other important tasks.

This plant is not alone. Remote monitoring systems will continue to help fill staffing voids for maintenance managers who need to rebuild their teams after this unprecedented year, reprioritize workloads, and simply do more with less.

2. Keep production going.

Remote system monitoring enables facility management teams both on- and off-site to proactively address time-sensitive equipment needs.

For example, using a remote monitoring filtration technology as part of your CBM approach can help maintenance staff proactively catch a rise in differential pressure (dP) in a dust collector, which likely

means a filter is expired and needs to be changed. It can also read the particulate matter sensor in the exhaust of a collector and automatically send an alert when particulate levels are rising, so the team can prevent disruption and unplanned downtime.

Over time, recorded monitoring data is saved in a timeline that shows the historical performance through graphs and charts. These insights are shared in reports that help track scheduled and unexpected downtime and highlight trending issues that might require a longer, more time-intensive repair plan.

3. Manage, track, and stay compliant.

Some states and local counties have regulations that require facilities to conduct in-person dust collector checks for two reasons: to manually record data like dP on a clipboard to meet air permit requirements, and to visually inspect the equipment for issues like particulate levels in the dust collector exhaust.

However, manual, in-person checks and visual monitoring are prone to human error, so it's best to supplement them with a remote monitoring system that sends alerts when a function is out of your preset parameters. This enables a cross-check of manual findings with the system's reporting analysis.

Looking for the Right Monitoring-connected Filtration Service

Having remote monitoring of filtration equipment makes sense, but what should manufacturing companies look for when deploying such a maintenance plan? First and foremost, the remote monitoring system should be easy to deploy. One big advantage of IoT-based technology when compared to traditional control systems is that it is easy to set up and does not require specialized personnel. In addition, it works with all brands of dust collectors, new and existing, so manufacturers don't need to replace their existing collector.

An IoT-based system also provides secure cloud communication, so your dust collector performance data is separate from your internal control systems and local Wi-Fi networks. This not only safeguards the security of the overall network, but it frees up IT to focus on other areas of the plant.

Second, make sure the system is designed specifically for dust collection. Some generic control systems are designed to manage production systems with extremely low latency. As a result, they are actually *overdesigned* and prove costly for monitoring a dust collector. Traditional control systems also can require the work of specialized engineers, often from outside the organization, to complete the integration process, which can be costly. You should look for a service that does not require any specialized resources—ideally one that connects to a web-based application in which the user only needs to log in to get the service running.

The challenges with a generic service don't end there, though. In fact, some generic monitoring systems generate "nuisance alerts" that flag when a dust collector simply starts up or shuts down. You should look for an application that is intelligent enough to determine why a machine is shutting down or turning on, and generate alarms only when there is a performance issue that needs attention.

Third, make sure the monitoring-connected filtration service meets your technical requirements. It should offer:

- Various sensor options so you can track the performance metrics that are most critical to your operations.
- Real-time email alerts, so you can address issues before they escalate.
- Automated data capture and reporting, which simplifies compliance reporting.
- An online dashboard that's easy to use and accessible to all necessary personnel.
- Analytics specific to dust collectors, like tracking pulse valve health.

By following these guidelines, you can avoid getting caught in situations where a critical dust collection system is suddenly "broke" and you have to "fix it."

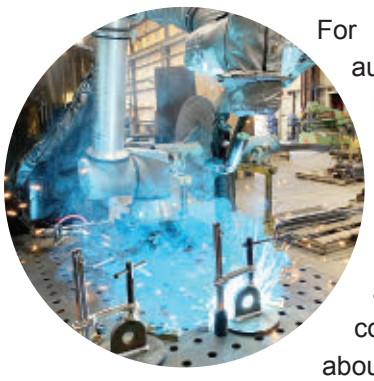
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FREE WEBCAST

This webcast was recorded on April 6, 2021

Fundamentals of Arc Welding with Collaborative Robots

UNIVERSAL ROBOTS



For years, traditional industrial welding automation helped companies address labor shortages, variable cost overruns and quality issues. But now, flexible, easy-to-program and quick-to-deploy collaborative robots are changing the landscape of welding automation… all for a fraction of the cost. In this webinar, you'll go in-depth about arc welding with collaborative robots, including the processes supported, the business case, typical ROI, safety considerations and welding-specific end-of-arm-tools. You'll also hear real-world case study examples of arc welding.



YOU'LL HEAR FROM:

Stuart Shepherd
Vertical Development Director, Americas
Universal Robots

Stuart ("Stu") Shepherd is the Vertical Development Director for the Americas region of Universal Robots. Stu's career spans more than 40 years in automation, including roles at General Motors, FANUC Robotics, Shepherd Solutions (a boutique automation business consulting firm), KUKA Robotics and Güdel AG. He joined Universal Robots in April 2018 and is currently responsible for growing UR's metal fabrication and machine tending markets in the Americas, utilizing his deep experience ranging from large-scale automotive to small job shops to welding integrators. Stu is also a Past Chairperson and Board Member of the Robotic Industries Association (RIA) and Past Chairperson of the Association for Advancing Automation (A3).

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BUILDING A VAST TUBULAR STRUCTURE, ONE IRREGULAR BLOCK AT A TIME

Fabricator uses robot technology to build concrete casting form for hydroelectric dam

By Eric Lundin

Your phone rings. It's a call about a bid on a fabrication job, and it sounds straightforward. The person on the other end of the line wants you to build something like a steel box. Not exactly a box, but a box with open ends. It's to be made from six pieces of plate—a top and a bottom, two sides, and two supports that run parallel to the sides. When finished, the box is to be 24 in. tall, 30 in. wide, and 36 in. long.

You need to cut the parts, fixture them, weld them, and clean up the edges. Sounds easy.

Well, it's not quite that easy. The customer needs boxlike structures that have other designs and sizes, some comprising up to 14 individual components, and then eventually you'll have to join one to the next, and the next, and the next.

An *assembly* of steel boxes. Got it. No problem.

But as the customer starts to describe the project in more detail, it becomes more complicated. He needs to pour some concrete—a little more than 1,000 tons—and he needs you to build a form for the casting process. The customer needs a lot of these boxes assembled to make the form. It's a big form and you need to make a lot of boxes.

It's becoming clear that you'll have to set up a cell for cutting and assembling the steel to make these boxes to make this form. You really don't have the manpower to take on a big project, but you know that you can use a robot for something repetitious like this. Fine, fine.

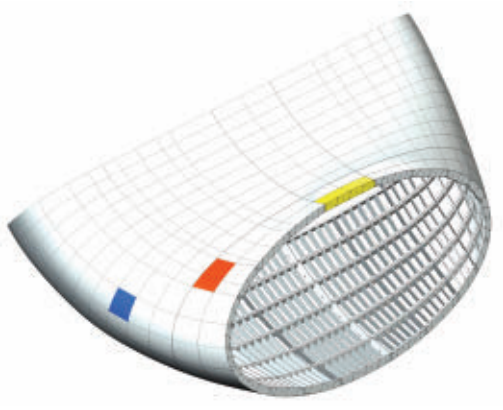
The customer—well, he's still a *potential* customer, but hopefully he'll be a customer soon—talks a little longer, and it turns out that you're not going to build a straight line of boxes in a row; the assembly will have a curve to it, so much so that the last box installed in the assembly will be joined to the first box.

How is *that* going to happen? Well, each box isn't really a rectangle. The sides are pitched.

Oh.

The modern world thrives on right angles and straight lines. Look at any manufactured item—an appliance, a machine, a cabinet, a shelf—and you'll see plenty of straights and 90s. Nearly everything is orthogonal. In architecture, nearly every building aside from those designed by the likes of Frank Gehry and Santiago Calatrava has sides that are straight and true, as is everything inside, from the walls to the plumbing.

These box structures won't be orthogonal. Your customer is talking about a curve. A big, sweeping curve. Well, that might not be too bad. Is he talking about a circle? Making a circular assembly would require a more complicated fixturing system than a rectangle would, but it's really not all that difficult. A circle has one radius, so one fixture would be suitable for every box in the assembly.



A rendering of a draft tube formwork shows the contours and the unique dimensions of each of the steel block structures in it.

You need to set up a workcell line to start cutting pieces to make slightly pitched rectangular forms and make a …

What's that now? It's not a circle after all. It's more along the lines of an ellipse. It's a circle that has been flattened, so the sides are curved gently and it has tight radii at its ends. An ellipse doesn't have any sudden changes in the radius, which means the radius changes continually and gradually along the circumference.

This is baffling. What is this project supposed to look like when it's finished?

The left half of the ellipse is a mirror image of the right half, but the top half is not a mirror image of the bottom half; moreover, after making this ellipse, you have to make another ellipse, one that is a little different from the first, and join them. And then you have to make and join another and another, until you have made 22 in all. Is this a *tube*? Yes, it's a tube. It's a tube that will be assembled bit by bit. Imagine slicing a tube into 22 rings. You're going to reverse that process, building one ring at a time and joining them.

You're going to need a lot of steel, a lot of welding wire, and a lot of time. Oh, and you're going to have to fixture all of the individual components that have irregular shapes and inconsistent sizes.

Designing a Draft Tube Formwork

Mankind has been building dams to control rivers for millennia; adding a hydroelectric generator to a dam is a bit of genius. The capital investment is vast and the maintenance cost is nothing to sneeze at, but it uses natural energy to make artificial energy. As long as rain is consistent and gravity doesn't give out, it's an excellent way to provide a steady stream of electrical current.

Designed and built to evacuate water from beneath a hydroelectric generator, a draft tube works as a sleeve to protect the dam. The dam is made from common concrete. It's a good material for building a reservoir to contain water, but it's not good for channeling water because it erodes too quickly. The draft tube is made from a specialized concrete that resists erosion even when exposed continuously to rushing water.

After the water leaves the reservoir and enters the hydroelectric unit's inlet, it circulates around the rotor, pushing the vanes that rotate the turbine, thereby expending most of its energy. At this point the water drops into the draft tube. Constructed with curves and contours, the draft tube guides water vertically away from the turbine, then changes direction and widens so the water slows down and exits the dam horizontally to rejoin the flow of the river below the dam.

Engineering firm Wenlock Ltd., Shrewsbury, U.K., was contracted to develop a process for building a series of draft tubes for the Grand Ethiopian Renaissance Dam. Ethiopia is a large nation, home to more than 100 million citizens. When the dam is finished, the hydroelectric generators will develop 16,000 gigawatt-hours of power annually, which will help to relieve the country's acute energy shortage.

It's hard to grasp the sheer scope of the project. As a point of reference, the dam is so large that the reservoir behind it likely will take from five to 15 years to fill. The dam is big, the generators are big, and the draft tubes are big.

One more thing: The dam-builder didn't put all its eggs in one basket. It contracted generators from two vendors. Each has its own designs for the generators, the water inlets, and, of course, the draft tubes. The fabricator that bids on this job will have to make draft tubes of two designs.

An Engineering Challenge Like Few Others

Fixturing a project with thousands upon thousands of unique parts is out of the question. If the fabricator were to build fixtures for this project, the time and effort for the fixtures would rival that needed to make the draft tube forms themselves.

The project came to the attention of Roberto Garziera, founder of Wenlock Ltd. Garziera draws extensively from his lengthy fabrication and design experience. His first job, one he worked every summer many years ago, was doing fabrication work for his father's business. Exposure to machines and tooling at an early age provided keen insights about using metal fabrication processes to make components and assemblies. Adept at drafting with pencil and paper, he later embraced advanced 3D drafting technology.



On the components of the draft tube formwork, the X, Y, and Z planes varied substantially.

His career has included designing industrial machinery, developing fabrication processes for components and assemblies for steel construction and infrastructure projects, and developing products and then designing the machinery and tooling needed to make those products.

"I understand design," he said. Like many people in manufacturing, he has seen his share of OEM customers who understand ease of manufacturing and those who don't. The reality of draft tube formwork is that it can't be designed for ease of manufacturing.

"The main difficulty was modeling more than 500 unique blocks with external surfaces that were irregular to coincide with the draft tube shape while their internal surfaces were regular enough for bolting the blocks together," Garziera said. "The construction also had to allow the dam-builder to apply props, install hatch doors for pouring the concrete and performing inspections, apply antifloating anchors, and allow dismantling."

So this is how it looked in detail: Make approximately 5,400 individual components and use them to assemble 528 box structures, then assemble those box structures into 22 rings of 24 box structures each, thereby completing one draft tube formwork.

"On every block, no two components were to be parallel or perpendicular to each other," Garziera said. "After positioning one component—let's start with the bottom plate—on the assembly table, it would be impossible to determine the exact location and orientation of any other component using common shop tools such as a ruler, square, or protractor."

For the workholding aspect, Garziera would need something versatile.

Everyone knows that metal fabrication equipment becomes more versatile with each passing year. Three or four decades ago, most machines performed one function, but the equipment designers have been combining machine functions for a long time. A single machine cuts and punches, forms and shears, cuts and threads, and so on. At the same time, advanced control systems and programmability have made machines extremely versatile, especially toolless machines like laser cutters and waterjets.

For workholding, such versatility is likewise available. It comes in the form of a robot. Equipped with fully articulated joints and augmented with the



An ellipse takes shape. Every component had to be accurate so every box structure and every ellipse would be accurate and all of the ellipses could be joined together to make one vast assembly.

unlimited versatility of a modern control system, a robot can be the ultimate fabricator or fabrication assistant.

For this project, using a robot to position each component for tack welding and then setting the assembly aside for manual welding in a later stage would be a possibility. That said, a successful implementation would require an unconventional use of a robot.

Certainly, the earliest robots were programmed, but those days are long gone. In the modern era, robots are *taught* rather than programmed. After setting up a sample workpiece in a workholder or jig, the operator moves the robot's arm manually to its initial location, then to the next location, then the next, until the arm has traced out the path. After this is done, the robot knows all of the start and stop points for each step, whether it's welding, cutting, deburring, or some other process. Another possibility is to manipulate the robotic arm by use of a joystick controller, but in the end, it's about the same as manually guiding the robot's arm.

In most circumstances, either of these is preferable to writing line after line of code to program the initial and final locations of each motion, the speed of each motion, instructions for turning the torch on and off, and so forth. However, making thousands upon thousands of unique parts, and getting them into position for welding, is not a case of "most circumstances." For this project, using the conventional methods for teaching a robot to start at point A and move to point B would require tracing the cutting paths between 260,000 of point A and 260,000 of point B. Needless to say, this was out of the question.

Could Garziera work out some other way to use the robot?



Rediscovering CNC

Although the word *manufacturing* implies a *manual* process, the modern concept uses automation, assembly lines, and consistency for efficient production, specializing in a low mix (preferably, zero mix) and high volume. The word *fabrication* is a variation of that, relying more on workcells than assembly lines and, of course, high-mix/low-volume work.

Making a draft tube form is an extreme case of high mix and low volume. Of the 5,400 individual components for this project, only a few were repeats. The fabricator would have to deal with every component as though it were unique, meaning this project had no mix.

Accuracy was another factor. Considering that any error in accuracy likely would be compounded across all 5,400 parts, it's difficult to conceive that the beginning and end of each ellipse would meet if the box structure dimensions weren't dead-on.

Without a viable strategy to make every part to the necessary accuracy, and precisely position for assembly each of the 5,400 unique, irregular parts with a jig, clamp, vise, or fixture, the subcontractor would run the risk of making a vast pile of scrap.

Garziera understood that the mode by which a robot learns a path is irrelevant. An operator can guide the robot's arm along the path or use a controller to manipulate it, or a programmer can enter each command line by line, but in any case, the input is data that the robot's controller turns into commands that it stores and uses.

Because Garziera had digital drawings of the draft tube formwork, he had enough information about each individual component's dimensions, location, and orientation to export linear transformation data to create the necessary commands to program the robot. It was more than just a possibility; it seemed to be the only practical way to execute this project.

"We found a fabricator that had the capacity for this project, and we even found a used robot for the fabricator to use," Garziera said.

In the end, Garziera devised a three-part strategy to make every part right on the money.

First, the fabricator would laser-cut every piece of steel for each box from a single piece of raw material so the thickness wouldn't vary. Some parts needed a bend, so those were bent accordingly.

Second, each piece would be picked up and placed by the robot onto a stable work surface, the cast iron table of a large milling machine. To get the location just right, the robotic arm would move each piece to the destination, then execute a fully articulated 3-axis motion—roll, pitch, and yaw—for a proper and consistent placement. After tack welding (by workers, not the robot) at the fixture location, the assembly would be set aside for traditional manual welding.

Finally, the robot would be programmed with another set of coordinates for final trimming with a plasma torch. This was done to finalize each part's dimensions, helping to ensure the tightest possible fit-up between mating edges before assembling the boxes to form the ellipse sections.

Once the process was up and running, it ran smoothly and required no rework, according to Garziera.

Success in a project such as this one is based on, and shows off, the capabilities of CNC machines and robots. After programming, setup, and some fine-tuning, the machines run flawlessly. The full scope of this project comprised two pairs of formworks for the two types of draft tube comprising more than 20,000 unique components assembled to form more than 2,000 blocks to make four draft tube formworks.

This project undoubtedly sets a milestone in advanced techniques for precision metal fabrication. Garziera's only disappointment is the orthogonal nature of nearly everything else in manufacturing and construction, which means this sort of solution isn't likely to be needed again anytime soon.

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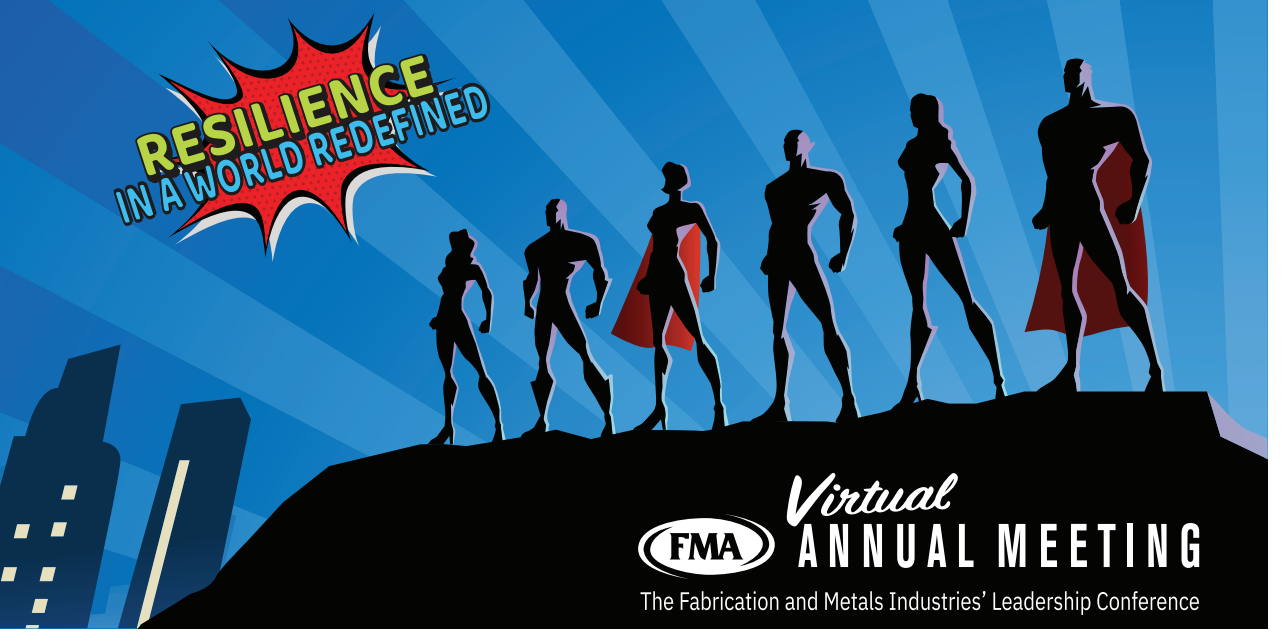
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FABRICATING HEROES PREPARE FOR BETTER TIMES AHEAD

The industry gathers intelligence and improvement tips at the 2021 FMA virtual Annual Meeting

By *The FABRICATOR* Staff

Metal fabricators that survived 2020 were celebrated during the Fabricators & Manufacturers Association virtual Annual Meeting March 3-4.

What did you do on your one-year anniversary of pandemic living? The Fabricators & Manufacturers Association hosted 400 members and other industry participants at its virtual Annual Meeting March 3-4 and celebrated the metal fabricating "superheroes" who did their best to keep employees safe and customers satisfied during one of the most challenging years they likely will have to endure.

After all, it was only two years before that the metal fabricating community gathered for the 2020 FMA Annual Meeting in San Antonio. The event was dominated by discussion of "disruptive technologies," but little did the world know that the true disruption would come in the form of an airborne virus with the potential to kill.

That's not totally truthful, however, because some metal fabricators already knew even as others went to industry events like the 2020 meeting or just went about their business. Speaking during a panel called "Stories of Manufacturing Superpowers" on the first day of the virtual Annual Meeting, Colin Cosgrove, president, Laystrom Manufacturing, Chicago, and Henry Moss, president, Metalfx, Willits, Calif., shared stories of how they were gearing up for possible changes related to the virus in the early part of 2019.

Cosgrove said that Laystrom had a customer with connections to the Wuhan province in China where the pandemic started, and as a result of hearing about some of these unfiltered reports, they started talking about what later would be called COVID-19 in February. It gave them a head start to develop some plans and start communicating with the company's employees.

Stress levels went up. Extra precautions were taken. Cosgrove said they experienced only one COVID-19 case during the first six months of the pandemic. Things got trickier when the second wave of COVID-19 cases spiked in the fall and a handful of other workers were diagnosed with the virus, but Cosgrove said Laystrom was able to push forward. Everyone was used to the new safety procedures and did what was necessary to ensure that customer deliveries were still meeting deadlines.

"Without question, though, it was the most challenging year in my 26 years of manufacturing," Cosgrove said.

Moss agreed. "There was totally no aspect of our business that didn't have to shift," he said of Metalfx, which employs about 200 people at its Northern California shop.

Metalfx got word of the virus from some of its Asian customers. Because of that, they knew they had to be ready.

"We knew we had to figure out how we were going to stay open. Closing wasn't an option," he said.

So, when the pandemic panic hit, Metalfx was ready. It had the proper paperwork to share with government officials indicating that the company had customers in the medical and utility industries that needed its parts. Metalfx demonstrated it was an "essential" business and was allowed to continue operation.

Internally, Metalfx enacted new policies quickly to help keep everyone safe. PPE was provided to everyone, and employees' temperatures were checked upon entering. Moss even shared a colored bracelet with the virtual audience, a visual indication that he had had his temperature checked; anyone not wearing the particular color of the day indicating a temperature check was done is someone that shouldn't be on the shop floor.

In the keynote address for the virtual event, Joel "Thor" Neeb, a former U.S. Air Force F-15 mission commander and now CEO of business consultancy Afterburner, drove home the point that the ability to see the challenge before you is a huge opportunity for anyone or any business. In dog fighting, that translates into doing whatever you can to see the enemy, even as 9 Gs are pulling down on your neck as you strain to find the opposing plane through the cockpit window. "If you lose sight, you lose the flight," he said.

Information puts metal fabricators in a better position to make smarter decisions about their business. Here is some of the information they picked up during the 2021 Annual Meeting.

Positive Signs Ahead

Armada Corporate Intelligence publishes its monthly "Armada Strategic Intelligence System" (ASIS), which delves into the various sectors of manufacturing, including fabricated metal products, electronics, appliances, automotive, and aerospace. As Chris Kuehl, managing director of Armada Corporate Intelligence, showed during his presentation, every manufacturing sector tracked in that report has a positive outlook for 2021. Fabricated metal alone is expected to be up 9.7% by the end of the year. "The fact that every sector ends the year in positive territory is extremely good news."

Kuehl didn't gloss over the challenges, including concerns over inflation thanks largely to dramatic increases in the money supply over the past year. "The idea now is to push money into the economy," Kuehl said, "but the fear is that it may have come too late … The economy is already recovering. So if you dump a bunch of money into the economy now, consumers [who really don't need it] may indeed spend it and the economy will overheat. When the economy overheats, you get inflation."

A related concern is the U.S. debt, but Kuehl put that debt in perspective. "If the [early 2021] stimulus package comes through, then the total amount of money the government has pushed into the economy since the pandemic began will be about $6 trillion. Well, China has contributed almost four times that amount. We've been obsessed with our debt-to-GDP ratio. It's at 110%, and ideally it shouldn't be more than 60%. China's is 280% of GDP. They are spending money as aggressively as they can to get the economy back on its feet. China can support that spending if lots of investment continues to go into China. But should that investment be interrupted, China would be in trouble immediately. Their debt is a lot more fragile than ours, since it is so dependent on international investment."

Other concerns relate to the supply chain and inventory. "The supply chain issues are one of the huge inhibitions out there," Kuehl said. "And we

have some ridiculous behaviors going on because there was such a disruption of the supply chain last year. Between 10% and 15% of the containers coming into the ports now were supposed to hit the ports last November."

Of course, the recent shortages come after a year when, thanks to all the pandemic-induced disruptions, inventories vastly mismatched sales. "Metrics related to inventory-to-sales ratios are finally calming down," Kuehl explained. "Last year people were caught flat-footed. Everyone had far more inventory than they knew what to do with, because demand just vanished. But demand has slowly come back, those inventories are slowly working down, and we're starting to get back to a normal pattern."

Capital spending is on the rise, too, especially in the small-business arena, where most of the country's metal fabrication takes place. According to the most recent "Forming & Fabricating Job Shop Consumption Report" published by FMA, small fabricators especially have shifted strategies. "Small businesses were not doing capex last year," Kuehl said. "Almost all the data we looked at showed delays in capital spending. But as we began this year, data showed that almost everybody was improving their capex predictions. They are all looking to buy more machinery, hire more people, and expand their capability in the hunt for more market share."

Kuehl continued with more positive metrics from transportation, with positive index readings in rail, trucking, and even air cargo. "Air cargo was really down for a long time now. But now it's way up, and there's a reason for that. The medical sector is in a hurry. Everything being shipped around the pandemic, whether it's protective gear, vials, or anything else, is going by air."

He added that economic predictions from large banks and think tanks are extremely robust. "The big banks are confident. They all think we're going to see [2021 GDP] growth rates of around 6.4%. Some think tanks are a little less enthusiastic and predict between a 4.5% and 5% growth rate. Given that the traditional rate is 2.5%, predicted growth is at least double that, which is to be expected since we're coming off extreme lows."

That doesn't mean dramatic improvements across all sectors, however. Because of the pandemic recession's unique nature, the recovery may come in fits and starts for some industry segments, creating a kind of "jagged V" recovery for some.

Steel Industry Perspective

Kuehl echoed many of the positive comments that came from fellow speaker Phil Bell, president of the Steel Manufacturers Association (SMA), Washington, D.C. "On a macro level, we expect the economy to improve in 2021. In fact, there's a good chance we'll get close to being at pre-pandemic levels," Bell said.

Many areas of the metal manufacturing economy have shown resilience, but weak spots remain, especially in the energy markets. "When we look at the energy market, oil country tubular goods continue to have a tough road ahead," Bell said. "There's already sufficient inventory here in the U.S. Much of it was imported and is sitting in yards and docks across the country …. Most experts think we're still five to 10 years away before we have a healthy OCTG market."



Bell also pointed to soft spending in nonresidential construction, a sector that until recently had been somewhat healthy, as contracts initiated in 2019 continued to move forward, taking advantage of the low-interest-rate environment of 2020. 2021 spending remains soft because of various factors, Bell said, "one of them being the lack of a long-term, well-funded, comprehensive infrastructure investment program." He added that, to spur the recovery, there might be a bipartisan agreement on infrastructure spending in the near future.

Not surprisingly, the forecast for carbon steel remains strong. According to Bell, SMA predicts demand to be up by 8.1% in 2021. He also expects mill capacity utilization to average in the low-70% range for the year.

Bell also described the steel industry's aggressive investment in technology, one that is likely to change the competitive landscape among the mills for decades. "Over the next three years there's going to be more than $13 billion in investment … [This includes] phenomenal growth and investment of electric arc furnace (EAF) steel producing. Most of these projects, even by traditionally integrated steel producers like ArcelorMittal and U.S. Steel, are EAF investments." Bell added that, after a decade of robust growth, EAF represents almost 70% of all steel production in the U.S.

With all this capacity coming online, why are steel prices so high? As Bell explained, "A lot of folks thought by now that steel prices would be dropping through the floor. Anyone who looks at current indices knows that's not even close to being true."

In truth, Bell said, the situation is a little more complicated. First, mills that modernize can outcompete less efficient mills, which in turn removes some capacity from the market. Displaced imports, thanks to Section 232 tariffs and other facets of trade policy, also reduce capacity. Finally, some capacity is "exiting" the market, a broad term Bell used to describe producers shifting gears to produce different products.

The Word From Washington

"Politics does affect your business," said Omar S. Nashashibi in his "Manufacturing 2021: How Washington, D.C., Will Affect Your Business" presentation. He is a founding partner with The Franklin Partnership in Washington, D.C., a lobbyist and consultant for manufacturing trade associations and businesses.

"Right now the Democrats have a single-party trifecta—the president, the House, and the Senate—paving the way for major changes in policies affecting manufacturers across the country," Nashashibi said. "One-party control really does change things," he remarked in his presentation.

The last time that happened was in 2017 when the Republicans passed the Tax Cuts and Jobs Act, and the time before that was when the Democrats passed the Affordable Care Act, he noted.

Although President Biden has only been in office since the latter part of January, his priorities are clear and a bellwether as to which legislation and policies will be enacted, he said. They are COVID-19 relief, the environment, rebuilding infrastructure, strengthening the Made in America Act, tax rates and credits, and trade and tariffs.

"COVID is Biden's first priority in March," Nashashibi said, both in terms of vaccinating Americans and passing COVID relief bills. The passage of the CARES Act in March 2020 expanded eligibility for unemployment benefits, but the $300 weekly federal enhanced unemployment benefits expired on March 14. So the Biden administration pushed to get the American Rescue Plan Act of 2021, a $1.9 trillion economic aid package passed in mid-March to rescue the 11.4 million workers facing the so-called jobless benefit cliff, he said.

"Clearly, the environment and climate change is a top priority for the Biden administration," Nashashibi said. Biden re-entered the U.S. in the Paris Climate Accord immediately after his inauguration.

During Biden's presidency, agencies are expected to review environmental rules and regulations. Also, regulation freezes will thaw.

Greenhouse gas emissions will be a large concern. Zero-emission vehicles will be in place by 2035, by government requirements or the market may move in that direction itself, he said, pointing to GM's zero emissions on light-duty vehicles by 2035.

OSHA guidance will form the basis for safety regulations. By March, temporary requirements were leaning to permanent, he said.

Infrastructure is one of Biden's top priorities, Nashashibi said. "On deck is infrastructure. Biden is pushing to allocate $1 trillion to $3 trillion for rebuilding highways, bridges, water, and transportation." He said that speculation is that Biden believes the U.S. may be facing another Great Depression and the country needs the stimulus to keep the economy going.

"Infrastructure has bipartisan support, for now," he said. "But we're going to have to pay for this debt. Then bipartisan support will fall apart. Taxes and user fees will have to go up. You are going to see tax increases taking effect in 2022."

Nashashibi said the corporate tax rate is not likely to increase to 35%; it will probably cap at 28%. Manufacturers that pay pass-through taxes are looking at closer to a 25% tax rate. In addition, the Department of the Treasury is working on a minimum corporate tax rate of 15%, he said. "They don't want big corporations paying just 5% anymore."

The Changing Workforce

For the first time in 34 years, the baby-boomer generation is no longer the majority in the workforce, having been replaced by Gen Y, also known as the millennials. As a result, employers are scrambling to learn how to relate with a younger workforce and address declining employee engagement, said Sarah Sladek, CEO of XYZ University and presenter of the session "Leading an inter-generational Workforce."

Sladek addressed two main questions: How do you manage people in this era and is team building even possible?

The answers to both are complicated, of course, because employers are dealing with work environments that house individuals from four different generations—baby boomers, born between 1946 and 1964; Gen X, born between 1965 and 1981; Gen Y, born between 1982 and 1995; and Gen Z, born between 1996 and 2009.

Sladek outlined the events that have shaped individuals from each generation and discussed how that manifests itself in the workplace. While boomers and Gen Xers are the last generations of the industrial era, Gen Y and Z are the first two generations that represent the postindustrial era, or what Sladek refers to as the talent economy.

"When postindustrial-era generations enter a company that is under industrial-era management, there is an immediate disconnect," Sladek said.

To manage different generations in chaotic times like these, Sladek said, companies must first recognize whether a majority of its workforce falls into the industrial-era or postindustrial/talent economy category.

"You have to think like a postindustrial company because turnover and retirement are imminent," Sladek said.

Is it possible to promote unity and team building among generations with such different expectations and communication styles?

The answer, according to Sladek, is yes, as long as employers understand the needs of their workforce. Bringing together individuals from different ages, genders, and experience levels can be a wonderful tool to address those needs. It's never a bad idea to empower teams to take ownership and bring their own ideas to the table. Also, inspiring collaboration between the generations is as simple as relationship building.

"Employee engagement is the outcome of building an organization that is exciting, fulfilling, meaningful, and fun," she said.

Speaking of Gen Z

When Seth Feldman graduated from high school a couple of years ago, he never considered a career in manufacturing.

"No one sat down with me when I was in high school and asked me if I actually wanted to go to college," he said during the "Recruiting the Next Generation of Manufacturers" panel discussion at the 2021 FMA virtual Annual Meeting. "I just always thought a four-year degree was the right path for me."

As it turns out, it wasn't.

"I didn't learn that way," said Feldman, who's now an intern at Wertzbaugher Services, a custom welding and fabrication business in Liberty, Iowa. "When I was younger, I never ever would have thought I'd be where I am now."

Sladek sat down with Feldman and two other young manufacturing professionals, Lindsey Lawton and Evan Williams of Jones Metal in Mankato, Minn., to get their thoughts on how the industry is handling the recruitment and retention of next-generation workers.

While shops have certainly made improvements in making the industry more appealing in recent years, Feldman, Lawton, and Williams, like other young manufacturing professionals, think that industry recruiters and educators need to be more aggressive in introducing the idea of a manufacturing career path at a much earlier age.

"I didn't know this was an option before ninth grade," said Lawton, who is a welder at Jones Metal. "I'm very grateful that I took the opportunity when I saw it, but most young people won't."

The panel agreed that it's not enough just to talk about manufacturing with kids. They need to be given a chance to experience it to truly get a better appreciation.

"Being as hands on as possible at a young age can really spark an interest," Lawton said. "I think people learn best by seeing and doing instead of just having to listen."

That also means being able to properly engage with the potential next-generation workforce. And it goes beyond the low-hanging fruit of enticement through social media platforms and YouTube.

Shops looking to recruit need to take the time to bridge the gap between students and the industry. Better collaboration between skilled trade classes at high schools and manufacturing shops is what's needed to truly garner interest.

"Right now it's mostly career fairs, touring facilities," said Williams, a project engineer and salesperson at Jones Metal. "When I was in high school, we did that. But it might be possible to have workshops within the school or company – getting students involved and maybe trying out welding or something on an off-day. Just looking is great, but actually being able to try it to see if you like it would be better."

Appropriate recruitment also means having a clearer understanding of the wants, needs, and communication methods of Generation Z workers.

Communicating via text or social media should no longer be viewed as a negatively stereotyped means of dialogue. Let's face it, the reliance and attachment to smartphones is a cross-generational way of life nowadays. And even though it's another tool to easily reach younger workers and open the door for efficient communication, that doesn't mean younger workers will shy away from face-to-face interaction.

"Global research shows that Generation Z workers actually prefer in-person communication, and that there's tech fatigue that plays a part," Sladek said during the virtual panel.

Developing a Technology Strategy

Steel producers are upping their technology game, and so of course are metal fabricators. Machine toolmakers at the conference described the latest in automation, including automated part offloading, automatic tool changes at the press brake, and seamless integration of cutting and bending.

Even so, many technology investments fall short of expectations, especially when it comes to what speaker Paul Vragel called the "digital transformation." Vragel is president of Evanston, Ill.-based 4aBetterBusiness Inc., a consultancy that helps manufacturers navigate the range of technological advancements that could either profoundly improve a company's profitability or simply fizzle into nothing.

"Robotic processes, automation, customer self-service, internet of things, virtual reality, digital twins, machine learning, artificial intelligence, even large-scale business model changes can be part of the digital transformation," Vragel said. "Digital transformation is less a specific item and more an entire category of things one might do in a company, depending on what is important."

For a transformation to be successful, Vragel laid out the process in five steps. First, the technology needs to align with a business's objectives. A technology, be it software or a new machine, might look incredibly sleek and extraordinarily productive, but if it doesn't align with a fabricator's business goals, all that productivity might not play a huge role in a company's long-term success.

Second, people and processes need to be addressed. "Research has shown that between 50% and 80% of digital transformation failures occurred because people and process issues had not been addressed," Vragel said. "The people who do the work are closest to the work."

Processes might be documented, but that documentation might lack detail or simply not reflect the reality of what's really happening on the shop floor. "Understanding and addressing processes also allows you to eliminate wasted time and money," Vragel explained. "And interestingly, as you do that and look into the processes, you identify wasted time and money. That in turn provides funding that you can use for acquiring technology."

Buying technology immediately after process improvement can be jumping the gun, though. Here, Vragel described several more steps, two of which involve data collection: specifically, defining the data for monitoring control and improvement, and examining the source and quality of that data, including the way it's organized, its format, the way it's communicated, and its age and accuracy. "If you look at a chart and it doesn't tell you what to do, then you're not looking at the right data."

Taking specific steps—aligning technology types with business objectives; understanding and addressing people and processes; defining the data for monitoring and improvement; and examining the source and quality of the data—builds a solid foundation for the final step: identifying specific technology that supports a company's objectives.

Industry at an Inflection Point

Vragel touched on an underlying theme shared by many speakers at this year's annual meeting: U.S. manufacturing, and metal fabrication in particular, might be at an inflection point. As manufacturing rockets out of its narrow-V recession, fabricators who watch the demands of the market, adapt, perfect their processes, and acquire technology in the right way—be it machinery, software, or both—build a solid foundation for what could be an unprecedented economic recovery. Judging from speaker insights, 2021 could be quite a ride.

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1960 SERAVESI SRL Rovato (BS), Italy																			
E79-S Series					✔			6-20	40-60	NC		✔			6-16	150	✔	✔	✔
RI 72 Series						✔		2-20	12-60	NC, CNC	✔	✔			.500-12	150	✔	✔	✔
RI 72-3 Series		✔		✔				2-20	12-40		✔	✔			.250-2	150	✔	✔	✔
E79 Series					✔			2-20	15-40	NC		✔			1-6	150	✔	✔	✔
E79-COR					✔		✔	5-10	To Spec..	NC-CNC	✔	✔			To Spec..	52		✔	✔
RI 72-COR						✔		5-10	To Spec.	CNC		✔			To Spec.	55		✔	✔
RI72-3 COR		✔		✔				5-10	To Spec.			✔			To Spec.	55		✔	✔
VBM Vertical Tank System								3-8		NC		✔			.125-.625	50			✔
AKYAPAK Tampa, FL																			
AS Series 3-Roll			✔					3-6	2.7-3.7	Manual			✔		16-19 ga.	36	✔	✔	✔
ASM Series 3-Roll			✔					3-6	4.3-5.5	Manual			✔		8-14 ga.	36	✔	✔	✔
ASM-S Series 3-Roll			✔					5-10	5.5-8	Manual			✔		8 ga.-.313	36	✔	✔	✔
AHK Series 3-Roll				✔				4-40	6-40	Manual, NC, CNC	✔	✔			8 ga.-8	38	✔	✔	✔
AHV Series 3-Roll					✔			4-40	6-40	Manual, NC, CNC		✔			2.75-10.25	38	✔	✔	✔
AHS Series 4-Roll						✔		4-40	6-40	Manual, NC, CNC	✔	✔			8 ga.-8	38	✔	✔	✔
Customized Model	✔	✔	✔	✔	✔	✔	✔	3-40	2.7-52	Manual, NC, CNC	✔	✔	✔		8 ga.-10.25	To Spec..	✔	✔	✔
BOSCHERT MÉXICO—GRUPO IDEMET SA DE CV Benito Juárez, DF Mexico																			
AMB Picot RCS 1100				✔			✔	3.5	5.3-9.25	NC, CNC	✔	✔			.127-0.4	34.8	✔	✔	✔
AMB Picot RCS 2100				✔			✔	3.6	5.3-9.25	NC, CNC		✔			.196-0.629	34.8	✔	✔	✔
AMB PICOT RCS 2100				✔				6.88	5.310-18.11	NC, CNC	✔	✔			.125-1.450	34.8	✔	✔	✔
AMB PICOT RCS 2600				✔			✔	8.530	5.9-18.10	NC, CNC	✔	✔			.125-1.450	34.8	✔	✔	✔
AMB PICOT RCS 3100				✔			✔	10.170	5.9-21.635	NC, CNC	✔	✔			.050-2.00	34.8	✔	✔	✔
AMB PICOT RCS 4100				✔			✔	13.45	6.88-18.11	NC, CNC	✔	✔			.125-1.450	34.8	✔	✔	✔
BOSCHERT USA Butler, WI																			
Picot RCE				✔				3.6-6.8	4.5-5.1	NC, CNC	✔	✔			16 ga. -.25		✔	✔	✔
Picot RCS 135-10/460-20				✔				3.6-6.8	5.3 - 18.1	NC, CNC	✔	✔			11 ga.-1.5		✔	✔	✔
Picot RCS 150-25/460-40				✔				8.5 - 13.4	5.9 - 18.11	NC, CNC	✔	✔			11 ga. - 1.3		✔	✔	✔
Picot RAE Asymmetrical				✔				3.3-6.6	3.5-4.5	Manual				✔	16 ga. - 10 ga.		✔	✔	✔
Picot R4C 205-10/460-20						✔		3.6 - 6.8	8.07- 18.11	NC, CNC	✔	✔			.25 - 1.5		✔	✔	✔
Picot R4C 205-25/460-40						✔		8.5 - 13.45	8.07- 18.11	NC, CNC	✔	✔			14 ga. - 1.45		✔	✔	✔
CO.MA.L/JD FORMAT SRL Milan, Italy																			
	✔	✔	✔	✔	✔	✔	✔	1.64-13.5	2.36-21.65	NC, CNC	✔	✔	✔	✔	14ga -2.56	50	✔	✔	✔
COLE TUVE INC. White Marsh, MD																			
IR			✔					3-6	1.81-2.95				✔		22 ga.-14 ga.				
MSM			✔					3-6	3.54-3.94				✔		16 ga.-10 ga.		✔		
IRM			✔					3-8	4.33-5.51				✔		14 ga.-.1875		✔		
MRMS			✔					3-10	5.12-8.66				✔		11 ga.-.375		✔		
MRMH			✔					2-13	3.15-9.84					✔	16 ga.-.563		✔		
3R HS, 3R HSS				✔				6-13	8.27-21.66			✔			.250-2.156		✔	✔	✔
3R UHS					✔			8-13	17.72-26.77	NC		✔			1.50-4		✔	✔	✔
4R HMS						✔		2-13	2.36-9.84	NC				✔	25 ga.-.375		✔	✔	✔
4R HS, 4R HSS						✔		3-13	5.91-26.77	NC, CNC		✔			.250-2.750		✔	✔	✔
COMEQ INC. White Marsh, MD																			
Americor Model 4RDP								2-10	3.15-9.84	NC	✔	✔			16 ga.-1.25	52		✔	✔
Americor Model 3RSP	✔		✔					2-10	3.15-13.40	NC					16 ga.-1.25	52	✔	✔	✔
MG	✔							30	To Spec.	NC, CNC	✔	✔			To Spec.	To Spec.	✔	✔	✔
Custom Models	✔	✔	✔	✔	✔	✔	✔	To Spec.	3-50	To Spec.	✔	✔	✔	✔	To Spec.	To Spec.	✔	✔	✔
CARELL CORPORATION Stapleton, AL																			
4R-VBH Series						✔		3-24	4-36	NC, CNC	✔	✔			.120-6	36-50	✔	✔	✔
4R-HS Series						✔		3-12	6-14	NC, CNC		✔			.25-1.0	36-50	✔	✔	✔
4R-DTS Series						✔		2-18	3-7	NC, CNC		✔			20 ga.-.18	36-50	✔	✔	✔
4R-HDTS Series						✔		2-18	4-8	NC, CNC		✔			16 ga.-1.00	35-50	✔	✔	✔
3R-TBH				✔				3-24	4-36	NC, CNC		✔			0.120-6	36-50	✔	✔	✔
3R-PCO Translating					✔			3-24	12-36	NC, CNC		✔			.75-6	36-50	✔	✔	✔
3R-HS				✔				3-10	8-13	NC, CNC		✔			.025-.75	36-50	✔	✔	✔
Q41 Series						✔		3-12	4.3-7.5	NC, CNC	✔		✔		20 ga.-.3125	36-50	✔	✔	✔
A31 Series			✔					3-10	4.5-7.9	NC	✔		✔		.035-.375	36-50	✔	✔	✔
LS Series			✔					3-6	2.4-4.5	NC			✔		20 ga.-12 ga.	36-50	✔	✔	✔
MRM Series			✔					3-12	2.4-4.5				✔		.13-.375	36-50	✔	✔	✔
2R Series	✔							2-5	3-5	NC			✔		22 ga.-.123	36-50	✔	✔	✔

2021 FORMING & FABRICATING® PLATE ROLLING MACHINE BUYERS' GUIDE®

Model or Series	Machine Type and Features: Two-roll (Urethane-coated)	Three-roll, Pyramid	Three-roll, Initial Pinch	Three-roll, Double Pinch	Three-roll, Variable Geometry	Four-roll, Double Pinch	Specialty Machines (Aircraft and Shipyard Applications)	Roll Length Range (ft.)	Top Roll Diameter Range (in.)	Controls	Available in Vertical Format	Roll Positioning and Drive System: Hydraulic	Mechanical	Other (Hybrid or Pneumatic)	Material: Material Thickness Range (in.)	Strength (Yield Strength at Rated Capacity, KPSI)	Options: Cone-rolling Capability	Infeed Tables	Sheet Supports
DAVI INC. Dallas, TX																			
MCP		✔						4-20	4-60	CNC	✔	✔			.25-16	62	✔	✔	✔
MCO				✔				4-30	4-60	CNC	✔	✔			.25-16	62	✔	✔	✔
MAV					✔			4-40	10-60	CNC	✔	✔			.75-16	62	✔	✔	✔
MCA-MCB						✔		4-40	4-60	CNC	✔	✔			.25-16	62	✔	✔	✔
AER							✔	4-40	2-20	CNC		✔			12 ga.-1	62	✔	✔	✔
DURMA/DURMA NORTH AMERICA INC. Lake Orion, MI																			
MS			✔				✔	3-10	2.2-8.6	DRO	✔		✔	✔	.040-.314	35	✔	✔	✔
HRB-3				✔	✔		✔	6-10	7.2-15.7	DRO	✔	✔			.25-1	35	✔	✔	✔
HRB-4DC-Dynamic Crowning						✔	✔	6-10	6-10	CNC		✔		✔	.25-.75	35	✔	✔	✔
HRB-3V					✔		✔	10 & 13	14 x 40	PLC-NC		✔	✔	✔	.44-6.5	35	✔	✔	✔
HRB-4						✔	✔	5-26	5.5-30	NC, CNC	✔	✔			.157-4.7	35	✔	✔	✔
E.G. HELLER'S SON INC. Los Angeles, CA																			
	✔			✔	✔	✔		4-28	3.5-38	NC, CNC	✔	✔			16 ga.-10	50	✔	✔	✔
FABRICATION SOLUTIONS & TECHNOLOGIES Longview, TX																			
Haeusler HDR					✔			6-20				✔			2-14		✔	✔	✔
Haeusler SPBM							✔			CNC								✔	✔
IP			✔					3-8	7-7 1/16			✔	✔		3/16-1/4		✔	✔	✔
SR			✔					3-8					✔		16 ga.-3/8		✔	✔	✔
Hi-Tech Pneumatic						✔	✔	20-51	3-4.17	NC	✔			✔	13 ga.-24 ga.			✔	✔
Hi-Tech Hydraulic						✔		20-78	5.1-6.7	NC, CNC	✔	✔			18 ga.-3/16		✔	✔	✔
SIHR				✔				6-30	7.8-13		✔	✔			1/8-7/8		✔	✔	✔
SIH				✔				6-30	13.78-25.6		✔	✔			1/2-4		✔	✔	✔
4R						✔		6-30	6.7-17	NC		✔			12 ga.-2		✔	✔	✔
4RH						✔		6-30	15.35-26	NC, CNC	✔	✔			5/8-4		✔	✔	✔
3RHT					✔			6-30	15-32			✔			5/8-5		✔	✔	✔
Hi-Tech 2 Roll	✔						✔			CNC	✔	✔						✔	✔
Haeusler VRM						✔		6-20		NC, CNC	✔	✔			2-14		✔	✔	✔
FACCIN Tallahassee, FL																			
HCU Series	✔							2-8	2.50-15	NC, CNC	✔	✔			.030-.197	52	✔	✔	✔
ASI Series			✔					3-10	5-6.75	DRO			✔		.059-.354	52	✔		
3HEL Series				✔				5-13	6-13.375	NC		✔			.118-.984	52	✔	✔	✔
3HEP Series		✔		✔				5-20	6-38	NC		✔	✔		.236-5	52	✔	✔	✔
4HEP Series		✔				✔		5-20	6-38	NC, CNC	✔	✔	✔		.079-5	52	✔	✔	✔
HAV Series					✔			6-60	13.375-52	NC		✔			.591-17	52	✔	✔	✔
Specialty							✔	10-70	To Spec..	NC / CNC		✔			.032-6	52		✔	✔
4HEL Series						✔		3-32	5-48	NC, CNC	✔	✔			.19-5.9	52	✔	✔	✔
HAEUSLER Duggingen, Switzerland																			
EVO						✔		3-14	8-30	CNC		✔		✔	.125-3	35	✔	✔	✔
VRM						✔		2-30	8-65	NC, CNC	✔	✔			.25-16	52	✔	✔	✔
HDR					✔			2-30	15-65	NC, CNC		✔			1-16	52		✔	✔
FKB					✔		✔	8-40	.75-6	NC, CNC				✔	.02-.6	52	✔	✔	✔
SPBM					✔		✔	20-85	10-26	NC, CNC		✔			.5-2.0	52	✔	✔	✔
RMaut						✔	✔	.1-6	.75-20	CNC	✔	✔			.04-1.0	52		✔	✔
RMS					✔		✔	20-43	7.8-38	CNC		✔			.25-1.65	70		✔	✔
HHT					✔		✔	30-80	7.8-38	CNC		✔			.25-2.0	70		✔	✔
KAAST MACHINE TOOLS INC. Aldan, PA																			
RB			✔					3-6	2.1-3.7				✔		.036-.1345	36	✔	✔	✔
RDB-3M			✔					3-6	3-4	DRO			✔		20 ga.-11 ga.	36	✔	✔	✔
RBD-3M			✔					3-7	4-5.5	DRO			✔		14 ga.-.2	36	✔	✔	✔
RBD-3M		✔						3-10	5-8	DRO		✔			.188-.375	36	✔	✔	✔
RBD-3HL		✔						6-14	8.5-12	NC		✔			.25-.625	36	✔	✔	✔
RBD-3HD		✔						6-14	12-18	NC		✔			.5-1.5	36	✔	✔	✔
RBD-4HD						✔		3-14	6-21	CNC		✔			.5-2.25	36	✔	✔	✔
RBD-4MAX						✔		6-20	11-32	CNC		✔			.75-8	36	✔	✔	✔
KNUTH MACHINE TOOLS USA INC. Lincolnshire, IL																			
KR		✔						3.4-6.7	2.25-3.75				✔		.04-.12		✔		
KRM-A		✔	✔					3.4-6.7	3.5-3.75	Foot pedal		✔			.08-.13		✔		
KRM		✔	✔					3.4-6.7	4.25-5.5	Foot pedal		✔			.14-.22		✔		
KRM-S		✔	✔				✔	5.25-10.17	6.75-7.5	Digital display		✔			.16-.31		✔		
RBM						✔	✔	6.8-13.4	6.3-25.3	Digital display, NC or CNC		✔			.236-1.77		✔	✔	✔

Model or Series	Machine Type and Features											Roll Positioning and Drive System			Material		Options		
	Two-roll (Urethane-coated)	Three-roll, Pyramid	Three-roll, Initial Pinch	Three-roll, Double Pinch	Three-roll, Variable Geometry	Four-roll, Double Pinch	Specialty Machines (Aircraft and Shipyard Applications)	Roll Length Range (ft.)	Top Roll Diameter Range (in.)	Controls	Available in Vertical Format	Hydraulic	Mechanical	Other (Hybrid or Pneumatic)	Material Thickness Range (in.)	Strength (Yield Strength at Rated Capacity, KPSI)	Cone-rolling Capability	Infeed Tables	Sheet Supports
MG S.R.L. Fossano, Cuneo, Italy																			
PH-3 rolls					✔			3.44-15	14-60	CNC	✔	✔			.8-14	36	✔	✔	✔
G 3 rolls				✔				1.15-26	1.9-60	NC		✔			.0135-12	36	✔	✔	✔
M 4 rolls						✔		1.15-26	1.9-60	CNC, NC	✔	✔			.031-12	36	✔	✔	✔
F	✔							2-7		NC, CNC		✔			Up to .118	36		✔	✔
PARMIGIANI Cremona, Italy																			
HDC Aircraft							✔	6-30	1-8	CNC		✔	✔		.02-1.00	80	✔	✔	✔
HDC Shipbuliding							✔	20-60	8-30	CNC		✔			.25-4	60	✔	✔	✔
VBH 4-roll						✔		3-36	1-70	CNC		✔			.1-10	60	✔	✔	✔
PCO 3-roll variable axis					✔			1.5-27	5-70	NC, CNC		✔			.5-10	60	✔	✔	✔
TBH 3-roll pyramid type				✔				2-20	5-45	NC		✔			.2-6	60	✔	✔	✔
REVOLUTION MACHINE TOOLS North Salt Lake, UT																			
R-ECO			✔					3-10	2.67-7.08	NC	✔		✔		.375	39	✔	✔	✔
R-SMART						✔		2-40	5.51-16.93	NC, CNC	✔	✔		✔	16 ga.-1.5	39	✔	✔	✔
R-GIANT						✔		2-40	18.1-42	NC, CNC	✔	✔		✔	1-5	39	✔	✔	✔
R-HYBRID					✔			6-40	13.77-42	NC	✔	✔		✔	.75-8	39	✔	✔	✔
F-SMART							✔	6-60	.5-8	NC, CNC	✔	✔	✔	✔	16 ga.-2	39	✔	✔	✔
SAHINLER METAL MAKINA Bursa, Turkey																			
4R HSS 25 Series						✔		8.25	11-21.65	NC or CNC		✔				37.7	✔		
4R HSS 30 Series						✔		10	11-21.65	NC or CNC		✔				37.7	✔		
4R HSS 40 Series						✔		13.45	11-21.65	NC or CNC		✔				37.7	✔		
4R HSS 60 Series						✔		20	11-21.65	NC or CNC		✔				37.7	✔		
4R HSS 20 Series						✔		6.73	11-21.65	NC or CNC		✔				37.7	✔		
TRILOGY MACHINERY INC. Belcamp, MD																			
SWEBEND PB4-4 Roll						✔		3-32	4-40	CNC	✔	✔			10 ga.-8	42	✔	✔	✔
SWEBEND PB3-3 Roll Double-Pinch				✔				3-32	4.3-40	NC	✔	✔			10 ga.-8	42	✔	✔	✔
SWEBEND PB2W Production Rolls								0-10	Specialty machines with wedge system to create bend radius	PLC or CNC					0-.25	Any		✔	✔
SWEBEND QFH/QFV - Quick Roll	✔						✔	0-10	Specialty machines	PLC and CNC Auto load/unload	✔	✔			0-.25	Any		✔	✔
LEMAS-4 Roll						✔		4-1 0	3.14-7.87	NC		✔	✔		.063-.500	38	✔	✔	✔
LEMAS-3 Roll			✔					3-10	3.14-7.87			✔	✔		.063-.500	38	✔	✔	✔
SYNERGY AH4 4-Roll						✔		4-30	6-36	PLC	✔	✔			Gauge-6	38	✔	✔	✔
SYNERGY AH3 3-Roll				✔				4-30	6-40	PLC		✔			Gauge-6	38	✔	✔	✔
Refurbished Roundo Rolls	✔	✔	✔	✔		✔	✔	3-32	4.3-40	CNC	✔	✔	✔		10 ga.-8	42	✔	✔	✔
Roundo parts	✔	✔	✔	✔		✔	✔	Any	Any	NC, CNC	✔	✔	✔	✔	Any	38	✔	✔	✔
WESTWAY MACHINERY Mississauga, ON Canada																			
4R HS 15-170						✔		5	6.5			✔			.25	36	✔	✔	✔
4R HS 25-220						✔		8	8.5			✔			.25	36	✔	✔	✔
4R HS 30-245						✔		10	9.5			✔			.25	36	✔	✔	✔
4R HSS 30-280						✔		10	11			✔			.50	36	✔	✔	✔
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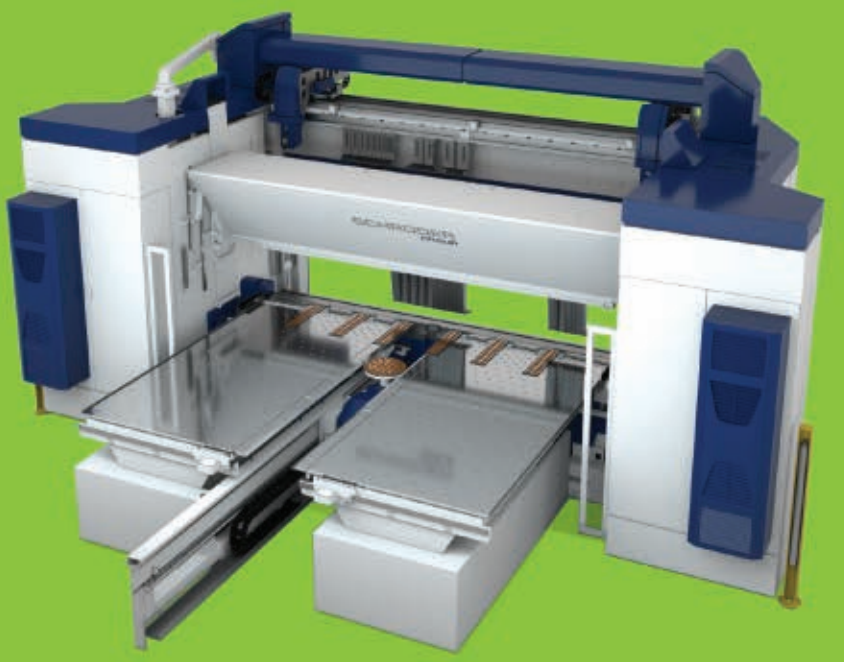
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Fabricator excels in artistic, structurally sound sculptures

Artist relies on decades of fab experience to develop breathtaking works in metal



Despite having no art background, metal fabricator David Windey has a knack for building flora and fauna with lifelike contours and imparting realistic textures.

By Eric Lundin

Fine artwork takes time. Raphael spent more than a year painting "La Fornarina." Leonardo da Vinci supposedly spent three years on "Last Supper" and four years on "Mona Lisa." Michelangelo worked on his most famous sculpture, "David," from 1501 to 1504.

It's a stretch to compare a modern metal fabricator with the masters of the Renaissance, but in the matter of perseverance, David Windey has something in common with them. The former fabricator who makes his living as an artist puts in a lot of time to build sculptures.

"It's a lot of hammer-and-anvil time," he said.

He spent most of his career working at a custom metal fabrication shop, Ritchie Metal Works (De Pere, Wis., near Green Bay). Decades in the shop provided an excellent foundation for Windey's current work.

"A spiral staircase is a good example," he said. Quite a bit of hard work goes into making such a project successfully and the outcome has to be aesthetically pleasing, dimensionally accurate, and robust. It's exacting, precise work.

"All of the little measurements are critical," he added.

Although precise measurements aren't always necessary in artwork, Windey relies on the fabricating knowledge, patience, and engineering principles he learned when working for Ritchie. One of his sculptures, an elephant that appears to be balanced on a ball, is a good example. Certainly, making an entire elephant is a daunting task, but Windey makes it sound easy, starting by making a leg, then another leg, then a foot, and so on. However, it's clear that it takes a vast amount of focus and perseverance.

Of course, other artists could do it too, and the first week might not be bad, but it's a relentless drive to finish the project that carries Windey through the remaining 19 or so weeks.

The other ace up his sleeve is his ability to build technically challenging pieces.

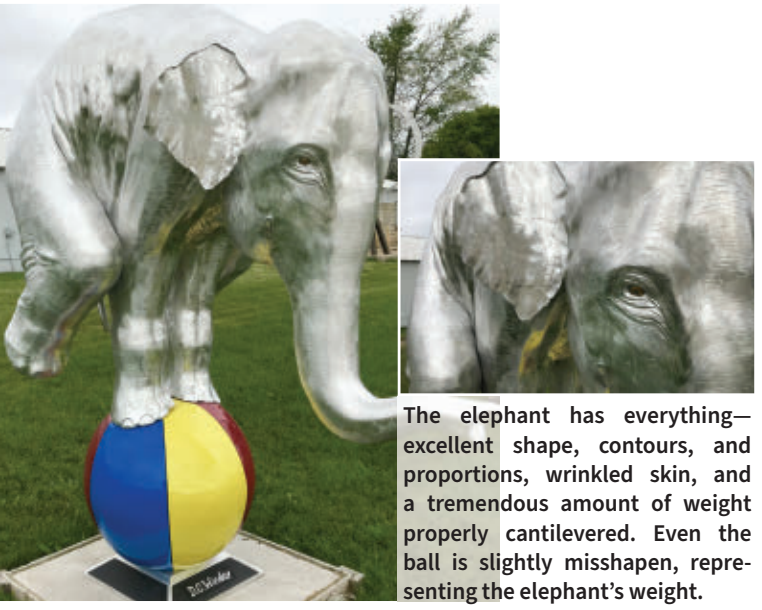
"I had to cantilever a lot of weight," he said. "Anyone can make an elephant, but can anyone make a strong elephant? I didn't want to warn people to keep children off of it because children like to play on things like this, so it's strong enough. They can climb on it, sit on the trunk, and it's not going to budge. I think you could lift it by the tail."

While the elephant is a showcase piece, he's known for making trees that dazzle. Windey advertises a basic 3-ft. tree, but the sky is the limit. While the tree trunks and branches are lifelike and natural-looking, it's the leaves that make them magical. On most trees, the leaves number in the thousands. Thousands upon thousands.



Windey has a standard price for trees starting at 3 feet high but he isn't tied to any specific type or style. This one, "The Transformation of Daphne," captures a moment from Greek mythology as the nymph Daphne escapes from Apollo to become a laurel tree.

"The leaves are available in any color or combination of colors and coated for UV protection," he said. The big deal is that the color application method is a holographic process, which gives the leaves a 3D appearance. The leaves aren't fixed to the branches; they hang and flutter in the wind, creating a breathtaking sight.



The elephant has everything—excellent shape, contours, and proportions, wrinkled skin, and a tremendous amount of weight properly cantilevered. Even the ball is slightly misshapen, representing the elephant's weight.



The elephant takes shape. All told, sculptor David Windey estimated that he put 800 hours into the project.

Contributing Editor Eric Lundin can be reached at ericl@thefabricator.com.

David Windey, www.windeymetalart.com

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