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MELTING POINT

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Time to Make the DONUTS

Inside This Issue:

Why Metalcasting?... Metalcasting produces engineered metal components for use in all facets of our world, including what you drive, where you live, what you eat and how you work. The metalcasting industry maintains its traditions while embracing advanced manufacturing techniques. But the key to metalcasting is what is illustrated in ***Melting Point*** magazine—the diverse ways metalcasting helps propel society forward. If you are interested in joining this forward-thinking industry, look to the sections of the magazine dedicated to Metalcasting Universities & Scholarships and Career Opportunities on pages 20-23.

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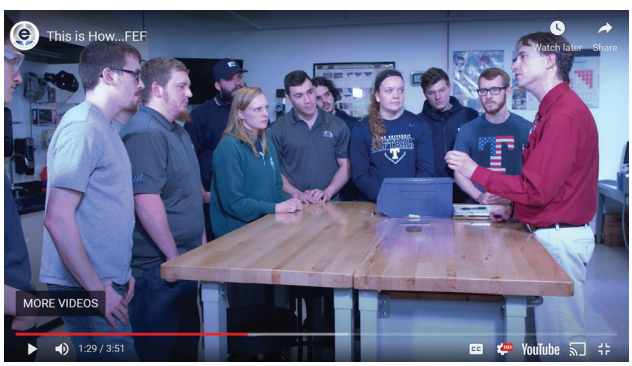
LIGHTS. CAMERA. CASTING

Check out these cool videos online!
Visit **meltingpoint.afsinc.org**
to view these videos and more.

What kinds of careers are in metalcasting? A video from the American Foundry Society looks at what it's like to work in the foundry industry through interviews with young workers doing a job they love.

With a career in metalcasting, you are involved in making products people use in their everyday life. In this video from Goldens' Cast Iron in Georgia, cast iron kamodo grills for backyard barbecues are made.



Know you want to go to college for engineering or metallurgy? Consider attending a college affiliated with the Foundry Educational Foundation. Scholarships are available, and graduates are highly sought after by employers in the industry. Watch the video at fefinc.org.

From Class Disruptor to Industry Star

Emily Shedlarski, Regional Account Manager for the Southeast at Simpson Technologies Corporation.

On her first day of class at the University of Alabama at Birmingham, Emily Shedlarski was given the choice of either writing a paper or working in the foundry as punishment for disrupting class. Although she didn't know what a foundry was, Emily quickly fell in love with it, especially after seeing her first metal pour. She went on to graduate from the University of Alabama at Birmingham, with a degree in Materials Engineering and later, a Masters in Information Engineering Management.

Shedlarski's involvement with the Foundry Educational Foundation (FEF) started during her sophomore year, thanks to FEF Key Professor Charlie Monroe. She went on to participate in casting competitions and toured foundries and steel mills. Needing to pay her living expenses, Shedlarksi started working at steel mills in Birmingham while also working in the on-campus foundry with Dr. Robin Foley. She received several FEF scholarships that helped her pay for summer classes. After attending an FEF College Industry Conference (CIC) in 2013, she knew she couldn't see herself working in the steel industry anymore.

"FEF activities really helped me develop a strong baseline, so when I started to look for a job in the competitive market it was

easy for me to get my first job as a foundry manufacturing engineer," Shedlarski said.

Upon graduation with her bachelors, Shedlarski joined Hubbell Power Systems in Leeds, Alabama. Working there for three and a half years, she was the project manager for a multi-million-dollar foundry replacement project. This project gave her the opportunity to expand her skill set, since she worked closely with the lawyers of the company to develop the quotation and legal contractual agreements between companies, international shipping, safety, and corporate finances. She was also the project manager for smaller projects such as rebuilding core machines, crucible furnaces and an outdated sand/metallurgical lab.

Her next career move took her to Mueller Water Products in Chattanooga, Tennessee, where she worked as a process engineer. In her role, Shedlarski worked with different departments to engineer solutions for production concerns that were negatively impacting the process and the bottom line. While there, she was promoted to project engineer and managed a metal recovery project that recovered over a million pounds of iron in seven months. in another project, worth approximately $1 million dollars, involved Shedlarski replacing the furnace controls in a customer's plant. Last, she acted as a technical liaison, going to different facilities to troubleshoot problems and managed cost savings projects to achieve corporate objectives.

In November of 2019, Shedlarski presented at CIC, where the CEO of Simpson Technologies Corporation saw her and offered her a position as regional account manager for the Southeast. She now does marketing, account management, makes sure the customers get the parts they need, and helps them with updates to their machines. She's also heavily involved in growing the customer base and increasing sales.

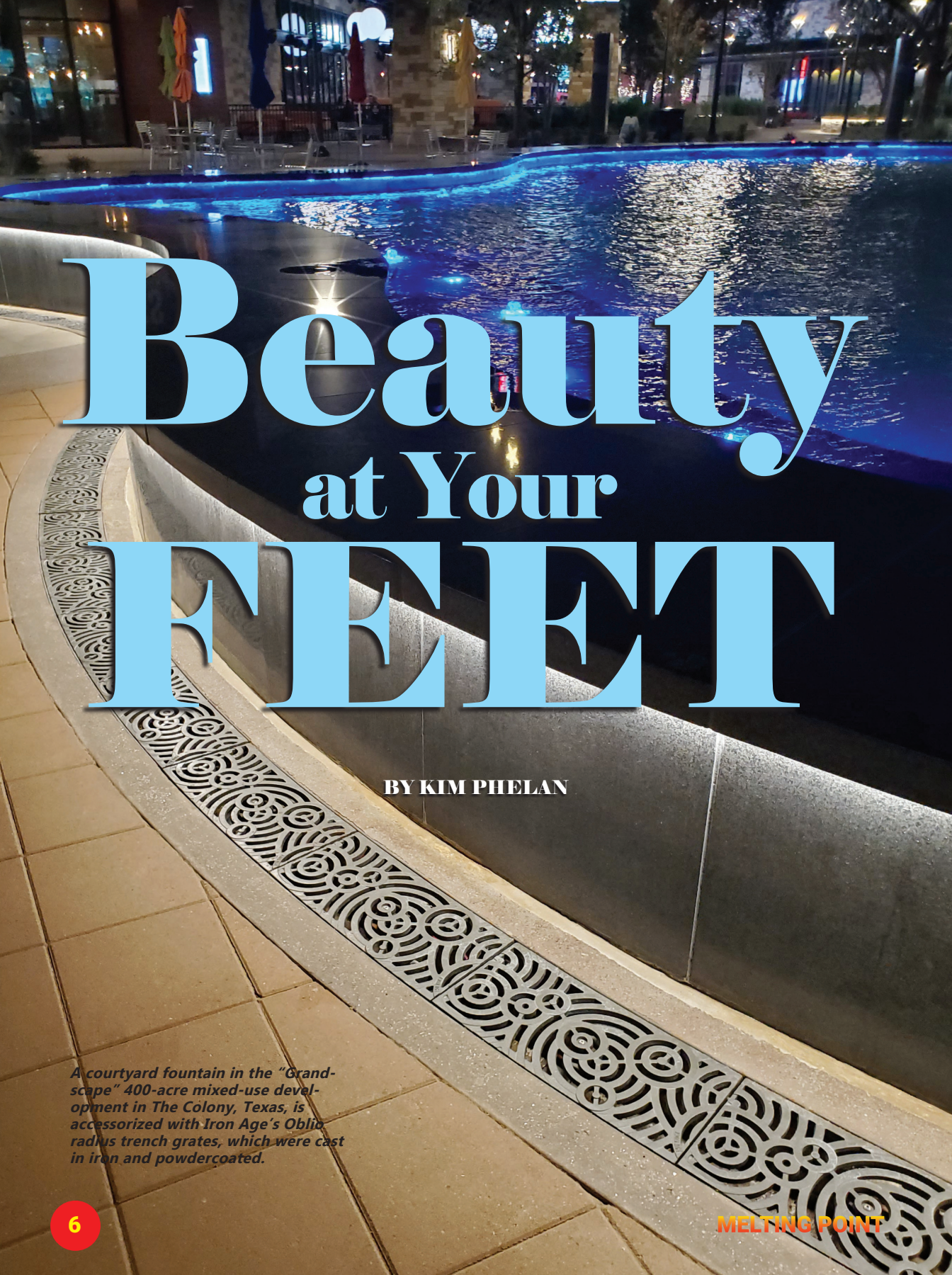
Sheldarski is on the FEF board and a member of the Fund Enhancement Committee, helping to organize the FEF Fitness Challenge. The challenge involved FEF students, alumni and friends forming teams and raising funds by logging in miles. Prizes included cast iron skillets and socks. She is passionate about this, believing it is important to continue to fund FEF schools and help students who don't have the financial means to complete their degree. Regarding student engagement, Shedlarski is involved in student chapters and frequently drops by FEF schools. In addition, she gives presentations as requested by different schools.

She says FEF program accreditation carries a lot of weight in the industry, and these programs supply students with basic skill sets that allow them to grow in their careers. The biggest benefit she said she received from FEF was attending CIC because it changed her life.

"They have the opportunity to see how invested the industry is in the future, which really is the students," Shedlarski said. "Arguably, FEF has done more for me than I could ever imagine. Even to this day, I am so grateful for it because I have a job I love in an industry I'm passionate about and I'm surrounded now by lifelong friends." MP

Beauty at Your FEET

BY KIM PHELAN



A courtyard fountain in the "Grandscape" 400-acre mixed-use development in The Colony, Texas, is accessorized with Iron Age's Oblio radius trench grates, which were cast in iron and powdercoated.

In a neon billboard culture where something screams for attention at every corner, Mark Armstrong believes humans still experience the world best within a five- or six-foot range, which is why his work—that dwells in the subtle, close-up enjoyment of unexpected beauty—is so fulfilling.

He's the co-founder and president of Iron Age Designs, whose flagship product is standard and decorative drain grates; the company also produces tree grates, metal registers and site furnishings. While these items are not glamorous, the team's creativity has turned the heads of clients specifying for jobs at Disney parks, as well as Universal Studios, the Lincoln Memorial and the National Mall, the National World War II Museum in New Orleans, the National Zoo, as well as for countless wholesalers, municipalities, parks, mixed-use developments, government installations and homeowners.

Iron Age was launched by Armstrong and a partner, who cut their career teeth together at a foundry that made the same kinds of products as the Burien, Washington-based firm does today—but the pair were bold enough to think they could "build a better mousetrap," said Armstrong.

Iron Age President Mark Armstrong educates the company's sales representatives about pattern materials for the sand casting process.

"Trying to search 'decorative drain grates' on the web was a joke," he added. "It just did not exist in 2005. At the time we began our business, and because of the exposure we had through the foundry we worked in, we identified these small trench and drainage castings as our way into business."

Staggered rows of concentric circles give the Spin tree grate a modern look with a subtle sense of movement, complementing the contemporary design of this landscaped courtyard/public plaza near Times Square in New York City.

A Little Help Goes a Long Way

Rich in originality and ambition, what the fledging group lacked was the bandwidth to buy and operate its own foundry. Iron Age performs and executes its design work in-house then hands off projects to either a patternmaker, fabrication shop or foundry as need dictates. Virtually everything from a manufacturing standpoint is outsourced.

Meanwhile, onsite, the company

Iron Age's decorative, cast iron planter fences are a versatile choice for protecting planting areas in urban settings. The Belle design shown at Bothell Multiway in Bothell, Washington, is priced in 12-in. increments with a variety of mounting options.

operates its own warehousing as well as finishing work, including patinas, powder-coat, and "oil baking" its castings with repurposed restaurant fry oil, similar to the process of pre-aging a cast iron pan. And Iron Age is cooking on the front burner today, doing about $7 million in business a year with 17 employees.

Offsite, Iron Age's products are poured in iron, aluminum and bronze. Armstrong noted they'll readily adapt to whatever alloy meets the aesthetic and function demands of the customer, for a price. It's the engineering brain-teasers that he enjoys most, and he knows he's in trustworthy hands with U.S. foundries that are experts when it comes to the most difficult of project puzzles.

"The folks at the aforementioned foundries work in close collaboration with our internal design department to tweak all sorts of things on basically every pattern to ensure it will run optimally within their system," Armstrong said. "As you know, each foundry is very different from the next. With the amount of new and unique custom work we do, this is a constant learning curve that is really part-specific for us.

Trends and Trepidation

With as much design depth as Iron Age has to offer, the current trend among its customer base toward simple, clean lines that barely exceed utilitarian is slightly surprising. Currently, its "regular Joe" grate patterns—"the plainest of the plain," Armstrong said—are offered in more size iterations than any other design. "And riffs on that pattern family, like our "Rain" pattern, are our fastest growing segment of our line. This will change of course, as tastes change, but it is interesting to see what sticks and what doesn't design-wise."

Functionally speaking, another trend

finds clients routinely specifying for a balance of dainty with heavy duty.

"They may have a pedestrian plaza that needs to anticipate garbage trucks, or semis or fire trucks—but it will drive you crazy!" said Armstrong. "I'd like to say 'pick one, but not both!' That said, it is a trend where these public spaces in denser urban areas need to be able to anticipate and accommodate multiple users and differing demands that on the surface would seem diametrically opposed to one another."

One current trend distinctly not unique to the making of drain grates is the rampant shortage of just about everything everywhere.

"That's the way of the weird wild world at the moment," said Armstrong. "The only saving grace is that we are all in it together; everyone, in one way or another. So, the general demeanor out there is a level of equanimity and acceptance of what can't be changed right now. Kind of like when we all holed up during COVID and worked from home and had executive Zoom meetings with kids and pets in the background. It just is."

Iron Age Designs carries no debt, so it is able to eye the future with more confidence than concern.

"Sometimes you eat the bear, and sometimes the bear eats you—sometimes we make money on projects and sometimes we lose, but we learn every time," Armstrong said. MP

San Francisco Public Works specified this custom, cast-iron planter fence for the Upper Haight district. The intricate design captures the personality and unique aesthetic of the neighborhood, which is a blend of both French and Victorian influences combined with a counterculture vibe.

Brain Teaser

Iron Age Designs likes to hang its hat on solving the most puzzling of projects, as well as those with added adrenaline-producing urgency. The company faced both with Universal Studio's Volcano Bay in Orlando, where a water feature required 10 five-ft. diameter bronze casting arrays from which water would shoot out and bubble over. The contractor client had formed and poured all the circles to receive the grates, but there was just one problem: No two circles were alike, and none were perfectly round.

"And they were in a hot hurry to open the park," said Mark Armstrong, president at Iron Age.

The team took the best as-built dimensions they could get, mapped them out, made their pattern, and, based on the largest of the circles, waterjetted each onto a unique, out-of-round dimension.

"I don't know how we made it on time—it was miraculous, but it happened ... the brain teasers are the ones you remember."

Time to Make the DONUTS

Belshaw Adamatic relies on North American foundries to keep the baked goods coming.

The last time you ate a donut from your favorite coffee chain, it was likely made with machinery manufactured by Belshaw Adamatic Bakery Group (Auburn, Washington). The company provides industrial and retail bakery equipment, including donut and bread production equipment, fryers, convection ovens, and deck ovens. Its customers include Dunkin' Donuts, Krispy Kreme, and the grocery store chain Safeway. Belshaw Adamatic buys the parts to make its equipment from 1,000 companies to keep pace with customer demand.

"We are the main supplier for Dunkin' Donuts, as well as customers with machines that require 24-hour operations," said Irene Kimmerly, vice president of sales at Belshaw Adamatic. "We have to have a lot of suppliers so we have alternatives in case somebody cannot produce for us."

More than 98% of the castings Belshaw Adamatic purchases are manufactured domestically.

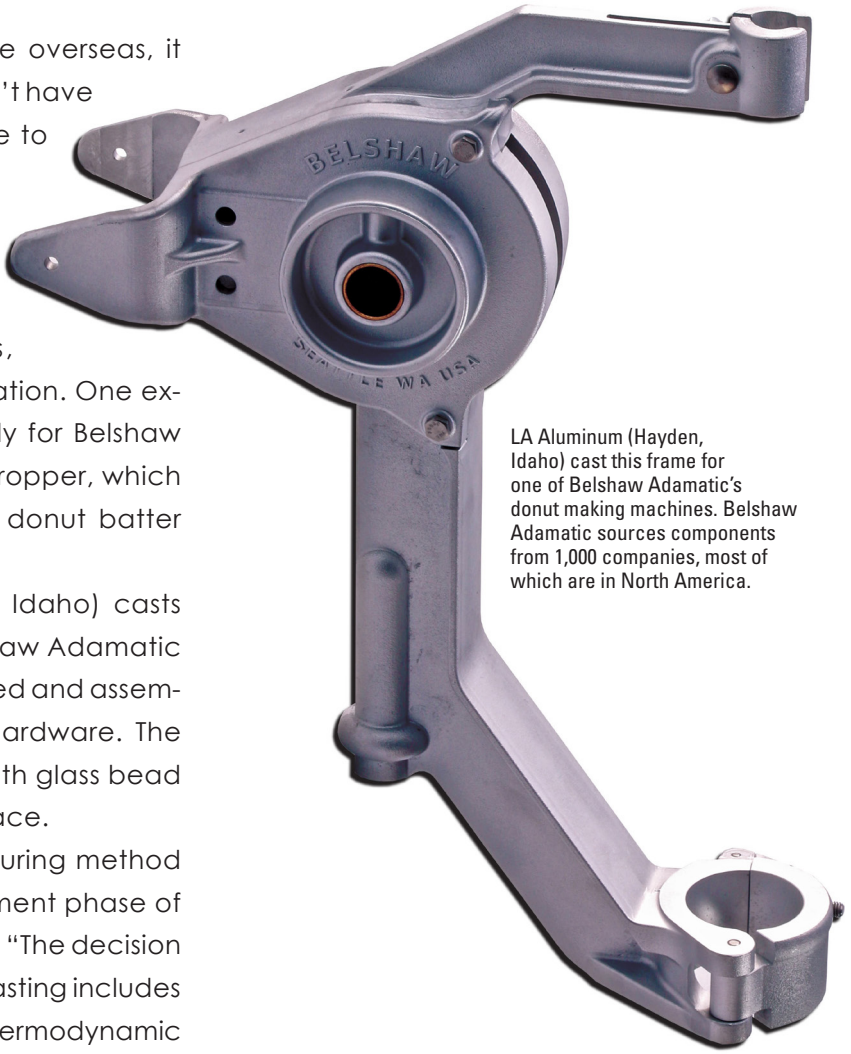
"That's part of the strategy, because often, we have to get those parts quickly," Kimmerly said. "If

we have something made overseas, it just takes too long. We can't have our customers not be able to produce."

The company purchases cast components in a wide variety of metals and casting processes, depending on the application. One example is a frame assembly for Belshaw Adamatic's cake donut dropper, which is a device that deposits donut batter into a fryer.

LA Aluminum (Hayden, Idaho) casts the donut frames for Belshaw Adamatic and delivers them machined and assembled with bushings and hardware. The frames also are finished with glass bead blasting for a smooth surface.

"Decisions of manufacturing method are made in the development phase of the design," Kimmerly said. "The decision criteria for when to use a casting includes functional performance, thermodynamic



LA Aluminum (Hayden, Idaho) cast this frame for one of Belshaw Adamatic's donut making machines. Belshaw Adamatic sources components from 1,000 companies, most of which are in North America.

Belshaw Adamatic's customers include Krispy Kreme, Dunkin' Donuts, and Safeway.

properties, as well as upfront and ongoing costs, and lead time."

Secure Sourcing

Belshaw Adamatics' customers range from small bakeries to large industrial facilities that make and package donuts for retail sales. It provides equipment that can make 100 dozen donuts an hour as well as automated lines that operate 24/7 at up to 3,500 dozen an hour. Having a secure supply of components for new equipment as well as replacement parts is critical to meet customer needs.

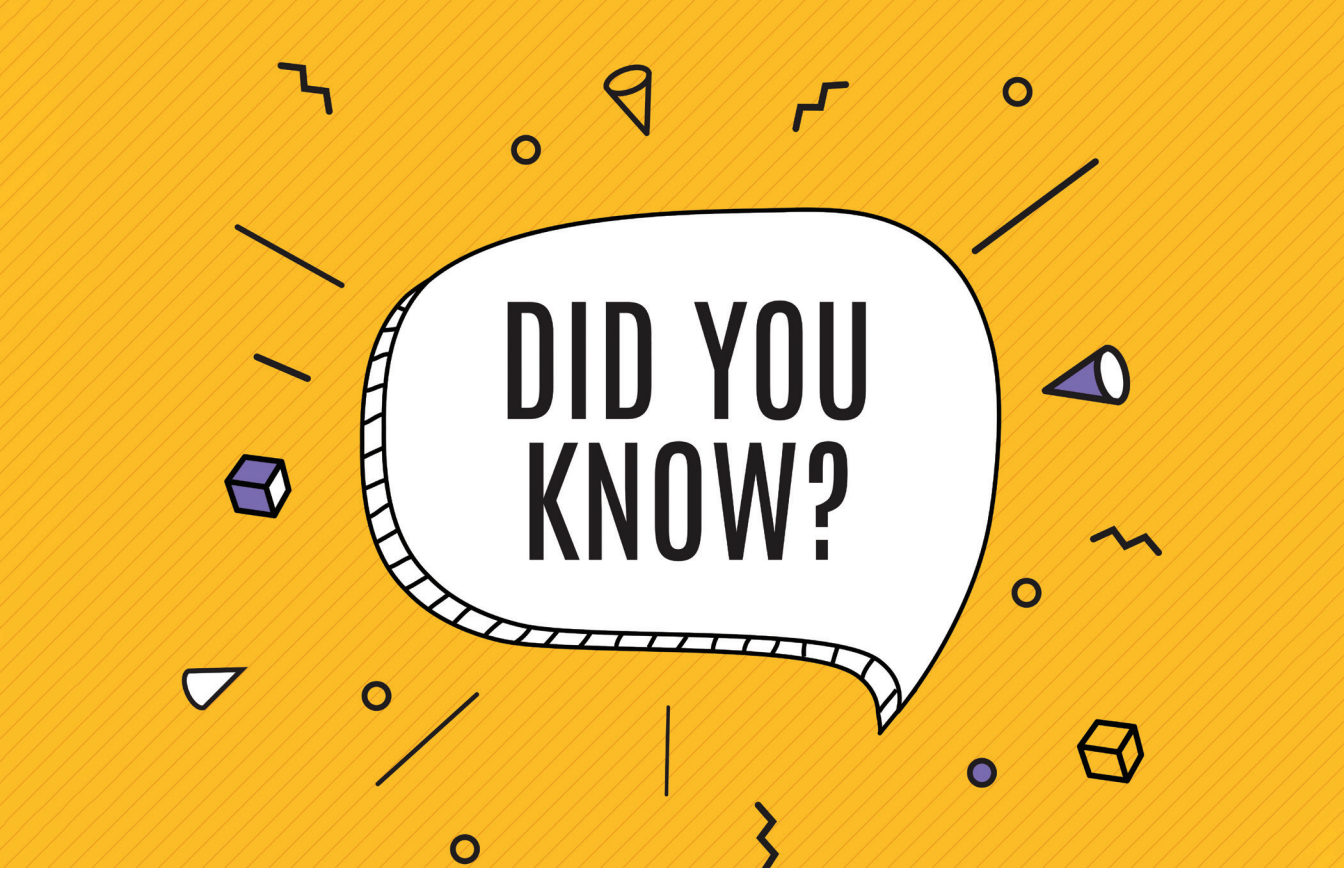
"It would be very rare to not find our equipment in a grocery chain or bakery," Kimmerly said. "We sell through our distributor base and direct to customer in some areas, so we go to market in a couple of different ways. Our philosophy is to secure a healthy supply chain because we can't have long lead times and we can't have people not producing."

Belshaw Adamatic employs three main purchasers to secure its supply chain. They are tasked with ensuring the current supply base is healthy, evaluating and potentially eliminating nonperforming suppliers, and continually seeking and developing new and alternative sources to avoid gaps in production. Belshaw performs regular audits of its suppliers and has a dedicated person who oversees the quality of incoming pieces.

"They are making sure the quality meets standard and that the suppliers haven't changed anything in the way they are producing the parts," Kimmerly said. "It's an ongoing process."

By keeping a healthy, domestic supply chain, Belshaw Adamatic can provide uninterrupted delivery of their machinery—some of which are worth hundreds of thousands of dollars—and be agile enough to respond to changing customer needs.

"We measure our success in customer satisfaction, and we want to make sure we are meeting the needs in an ever-changing market," Kimmerly said. "Service is a huge part of our success. We provide 24-hour tech service and having a secure supply chain is part of our ability to do that." MP



9 COOL COPPER FACTS

Cast copper is a versatile material with a variety of alloys, which are mixtures of metals and other elements to achieve certain properties. Copper alloys are used in plumbing fixtures, ship propellers, power plant water impellers and bushing and bearing sleeves because they are easy to cast, have a long history of successful use, and are readily available from a multitude of sources. In the U.S., copper accounts for approximately 2.8% of total casting production by weight, according to the 2018 World Census of Casting Production reported by *Modern Casting* magazine. Following are 8 qualities of cast copper alloys.

1 ***Almost all copper alloys retain their mechanical properties at low temperatures.***

Copper alloys typically are resistant to corrosion, are tough at impact, do an excellent job of conducting heat and electricity, and inhibit marine organism growth.

This copper-based casting was produced in the sand casting method, where molten metal is poured into a sand mold. The metal fills the shape of the mold cavity, and after it solidifies, the sand is broken away to leave the cast part.

2 ***All copper alloys can be produced via sand casting.***

Other casting methods for copper alloys include centrifugal, continuous, permanent mold, investment and diecasting. The choice of alloy and casting method determines the level mechanical and physical properties, thickness, and surface finish that can be achieved.

3 ***Leaded copper alloys still have several industrial applications.***

While leaded alloys are no longer used in drinkable water applications, they are still useful for other instances where low friction and wear rates are desired. For instance, high-leaded tin bronzes are cast into sleeve bearings and exhibit lower wear rates than steel.

4 ***As a class, cast copper-based alloys are easy to machine.***

Leaded copper-base alloys are the easiest to machine or cut away to produce the desired shapes and features (like holes).

5 ***Post-casting processing can further enhance cast copper parts' appeal.***

Secondary steps completed after parts are cast, such as polishing, plating, soldering, brazing and welding, can be performed on cast copper alloys for improved surface finish and high tolerance control.

6 ***Cast copper comes in a wide range of alloy choices, making it a suitable candidate for many applications, depending on design loads and environment corrosivity.***

7 ***The cost to make copper cast parts are comparable to other metals.***

8 ***Copper is anti-microbial.***

According to the EPA, surfaces of registered copper alloys (there are more than 500!) have shown to continuously kill bacteria within two hours of contact when cleaned regularly. Copper's medicinal properties have been recognized for centuries. As early as 2600 B.C., copper was being used to sterilize wounds and water in Egypt. Applications for antimicrobial copper castings include high-touch areas such as public transportation, healthcare settings, and sports facilities.

9 ***Copper is cryogenic.***

According to the Copper Development Association, copper and copper alloys retain a high degree of ductility and toughness at subzero temperatures and even get stronger and more ductile the colder they get, down to -424F. MP

Copper alloys provide antimicrobial protection to high-touch surfaces like faucets.

High School Manufacturing Program Equips A Jobs-Ready Generation

Manufacturers in the United States will need to fill more than 2 million jobs by the year 2030, according to the National Association of Manufacturers. That means a lot of job opportunities are on the horizon for today's students. But all forms of manufacturing, including metalcasting, require specific skills that must be learned on the job or in the classroom.

At one Washington high school, a teacher is working to create a generation of jobs-ready students who can hit the ground running after graduation, either by getting high-paying positions in the industrial sector or by pursuing more training in technical schools or universities. Chris Gallagher has established a manufacturing education program at Granite Falls High School that's second-to-none, with high-tech equipment and a full curriculum of practical skills across many industrial arts.

We asked him about the program, what students can learn from a manufacturing education, and how he built a foundry in a high school, of all places.

Note: *This interview has been edited for clarity and length.*

Question: What do kids learn when they take one of your manufacturing classes?

Gallagher: Students learn about safety with machines, hand tools, PPE [personal protective equipment] and the environment. They use Fusion 360 for CAD and learn how to create and read fully dimensional orthographic projection drawings. They learn how to use both semi- and precision-measurement tools, and we teach them how to safely operate a drill press, lathe, mill, stick welding, MIG welding, TIG welding, oxy-acetylene welding, CNC mill, CNC lathe, CNC router, CNC plasma cutter, manual plasma cutter, a green sand mulling machine, vertical and horizontal bandsaws, bench and hand grinders, a sand blasting

cabinet, powder coating, vacuum bagging for composites, and the oven for powder coating and composite curing.

Question: How is the program in your school structured?

Gallagher: First, the program has an introductory, half-semester manufacturing class, and that's for students who are maybe not quite sure what they want to jump into—if they want to go the path of manufacturing or maybe they want to take a look at other CTE [career and technical education] pathways offered. Then there's the Core 1, Core 2 and Core 3 three classes.

In Core 1, students build a hoist winch and an aviation stool, so they learn basic machining operations, sheet metal work, and some basics of welding. In Core 2, we build electric guitars, composite skateboards, and the hydraulic log splitter. Core 3 is learning how to operate all the CNC machines, set-up tooling, and program the machines using Fusion 360 to create the CAD/CAM programs. Students learn how to operate the CNC lathe and mills by making parts for the hoist winch, learn how to operate the CNC router by making tooling for casting snouts used on the blacksmith bellows, use the CNC plasma cutter for making molds for the plastic injection machines, and use the laser engraver by making parts for wooden clocks. The wooden clock is new this year, and they will also be making a working Stirling engine.

Question: What have you done to expand the foundry area of the school?

Gallagher: This high school was built around 2008, and they turned the old high school into a middle school—when they were doing some renovating over there, a maintenance worker came over and said, 'We're cleaning out some of the equipment ... do you want to take a look and see if you're interested in any of it?' I went over and I said, 'Hey, that looks like an old foundry furnace—I'd like to have the furnace.' It needed some repairs, like a safety switch put on it.

The foundry society in Washington reached out to me and asked me what I was trying to do, told me to make a list of what I thought I needed, and they would come by. Folks from three

foundries looked at everything we had and said I needed a mulling machine, green sand, tooling, flasks, crucibles, CO2 for making the cores, a handheld thermocouple, safety splats with leggings, gloves, and helmets with face shields. They agreed to offer support with equipment and materials but stressed the importance of safety by reaching out to their vendor to donate all the safety PPE needed.

Question: You're preparing these students so they can launch into careers just at a time when manufacturing is so eager for skilled workers. What kind of feedback do the kids give you about this program?

Gallagher: The kids really enjoy it. They like the hands-on. One of the things I do at the start of each of the classes is a job survey to see what they might be interested in. Maybe it's the medical field or the food industry. But if they're really looking for manufacturing, and they research what entry-level skills they would need for those jobs, and then they start looking at our program, they see we're offering those skills for apprenticeship programs, engineering, or tech school, or just getting a well-paying job right out of high school. That's my real goal—to hook these kids up with jobs right out of high school.

Of course, you have to work around the age restrictions. By law, they can't start letting 16-year-olds work. But as an example, Morrel Industries did find a job for a 16-year-old student—it was just basic stuff. Until he turns 18, they couldn't have him operating certain equipment, but they did find work for him, and he worked out really well for them.

Question: What keeps you so energized?

Gallagher: It's very empowering working with students and giving them those skills so they can start to make stuff. I'm teaching them, 'You don't have to take it to somebody else; you can fix it yourself.' It's also problem solving—teaching critical thinking skills.

Question: It's easy to see you didn't take the program this far by dreaming small. What's next for the Granite Falls manufacturing program?

Gallagher: My big hope is that we can tie in with industry and create an apprenticeship in the school for students who are really serious. A lot of them don't have a way to travel on their own, so rather than having to go to an employer and work with a journeyman, maybe the manufacturing shop could send them work to do here in the afternoon and I would check it off. Then they would go over to the company for their final evaluation. I've been talking to some folks in industry, and it sounds like it can almost be possible. And after school students could work there; in the summertime, they could work full time, and it would lead to a full-time job after they graduate. That's what I would really like to see. Then it would be a good program. MP

Casting Protects Truckers in Crashes

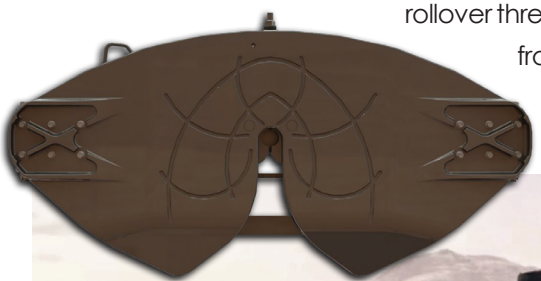
Truckers keep our economy humming—odds are, almost everything in your house was once transported on a semi-truck, whether it was delivered to your doorstep or purchased in a store. But truck-driving can be hazardous, especially when it comes to rollovers, the serious crashes that occur when a semi's trailer (where goods are stored) flips on its side and takes the tractor (the front of a truck, which contains the cab where the driver sits) with it.

That's where a creative California company, Axicle, comes in. They designed a piece of equipment that uses a casting to eliminate the risk of tractor-cab rollovers, protecting truckers in the event of a crash.

Axicle's TARS (Tractor Anti-Roll System) is made up of a suite of onboard sensors, a fast-acting "brain" that analyzes the threat of rollovers, and a life-saving quick-release system that engages in case of emergency. At the heart of the product is a cast steel plate that can handle 55,000-lb. loads under normal circumstances, but which helps to automatically ditch the trailer if TARS detects rolling. This keeps the cab and its driver upright and safe in the event of high winds, driver error, or other factors that can lead to rollover accidents.

"If the TARS system detects a rollover incident, it fires its pneumatic- or pyro linear-actuated anti-rollover release mechanism in the space of a millisecond and drops the trailer off the back of the truck," wrote Loz Blain on Automotive.com. In short, as soon as the TARS system senses a rollover threat, it automatically releases the trailer, saving the driver from the potential for serious injuries.

Axicle's TARS system is still being tested, but once it's on the market, it will sell for about $4,000. MP



Find a College to Study Metalcasting

Ready to launch your metalcasting career? Want to know where to get started? These colleges are optimal institutions to consider if you are interested in metalcasting as a career.

Arizona State University
Tempe, AZ

California Polytechnic State University
Pomona, CA

California State Polytechnic University
San Luis Obispo, CA

California State University—Chico
Chico, CA

Central Washington University
Ellensburg, WA

Eastern Michigan University
Ypsilanti, MI

Georgia Southern University
Statesboro, GA

Instituto Tecnologico De Saltillo
Saltillo, Coah, Mexico

Kent State University
Kent, OH

Michigan Technological University
Houghton, MI

Milwaukee School of Engineering
Milwaukee, WI

Missouri University of Science & Tech
Rolla, MO

Mohawk College
Hamilton, ON, Canada

Penn State Erie—The Behrend College
Erie, PA

Pennsylvania State University
University Park, PA

Pittsburg State University
Pittsburg, KS

Purdue University
West Lafayette, IN

Ryerson University
Toronoto, ON, Canada

Saginaw Valley State University
University Center, MI

Tennessee Tech University
Cookeville, TN

Texas State University—San Marcos
San Marcos, TX

The Ohio State University
Columbus, OH

Trine University
Angola, IN

University of Alabama—Birmingham
Birmingham, AL

University of Alabama—Tuscaloosa
Tuscaloosa, AL

University of California-Irvine
Irvine, CA

University of Michigan
Ann Arbor, MI

College Scholarships Available... YES!

Visit
American Foundry Society
Chapters at:
www.afsinc.org/chapters

Visit the Foundry
Educational Foundation at:
www.fefinc.org

University of Northern Iowa
Cedar Falls, IA

University of Wisconsin—Madison
Madison, WI

University of Wisconsin—Milwaukee
Milwaukee, WI

University of Wisconsin—Platteville
Platteville, WI

University of Wisconsin—Stout
Menomonie, WI

Virginia Tech
Blacksburg, VA

Western Michigan University
Kalamazoo, MI

Youngstown State
Youngstown, OH

CAREER OPPORTUNITIES

Do You Like:

- Science?
- Building things?
- Designing things?
- Being creative?
- Working with people?
- Solving problems?

Consider Metalcasting. We Need:

- Business Managers
- Chemical Engineers
- Computer Engineers
- Electrical Engineers
- Human Resources
- Safety Managers
- Accountants
- Quality Control Technicians
- Marketing & Salespeople
- Mechanical Engineers
- Metallurgists
- Skilled Tradespeople

Careers: Post High School

- Molder, Machine Operator, Pourer, Crane Operator
- Lab Technician, Quality Assurance, Welder, Furnace Operator
- Patternmaker, Maintenance Mechanic
- Electrician

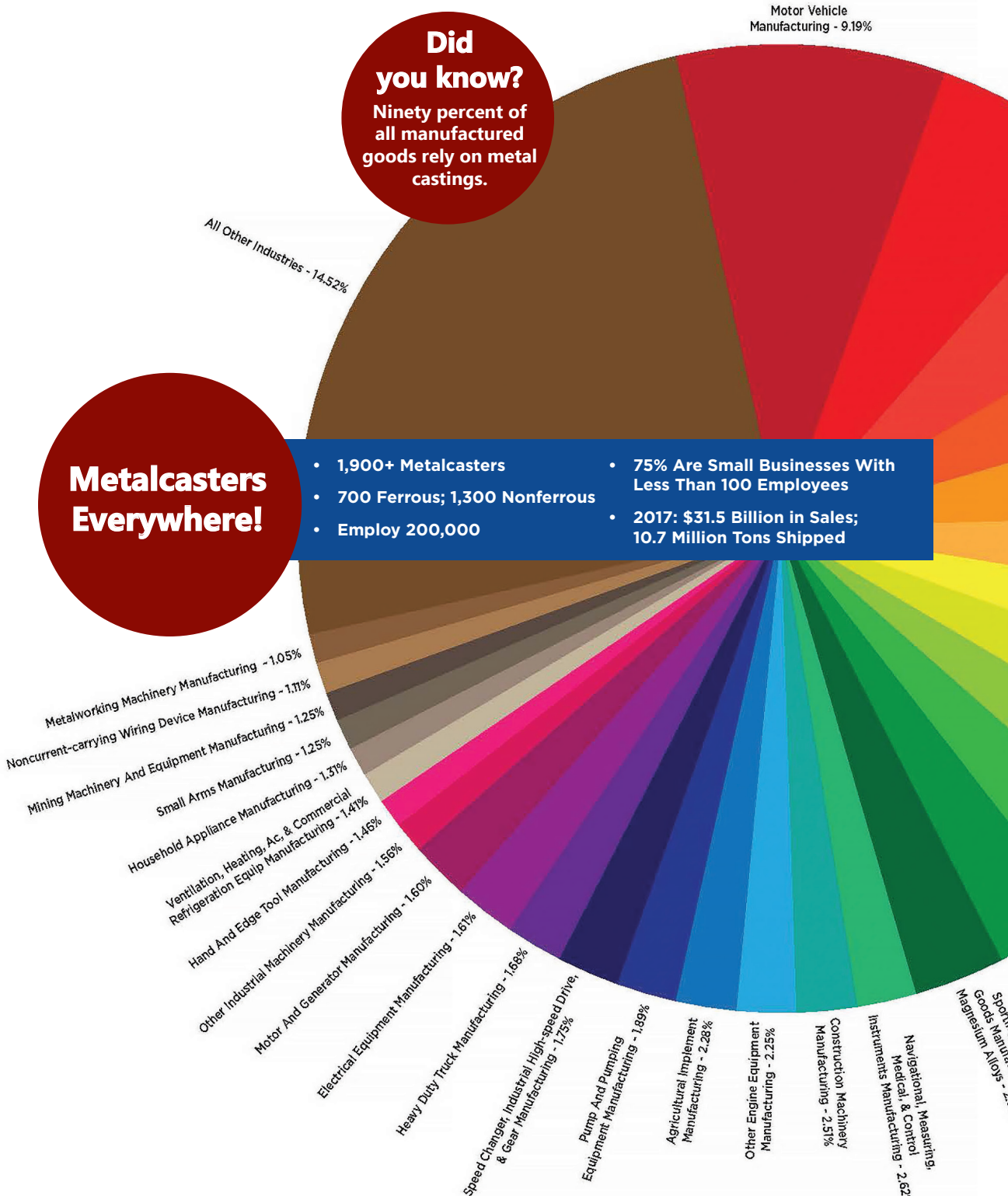
Careers: Post College

- Molding, Melt Superintendent
- Metallurgist, Quality Assurance Manager, Facilities Manager
- Engineering Manager, Plant Manager, HR Manager, Controller
- Sales Manager, Technical Director
- VP, President

WHERE DO CASTINGS GO?

Did you know?

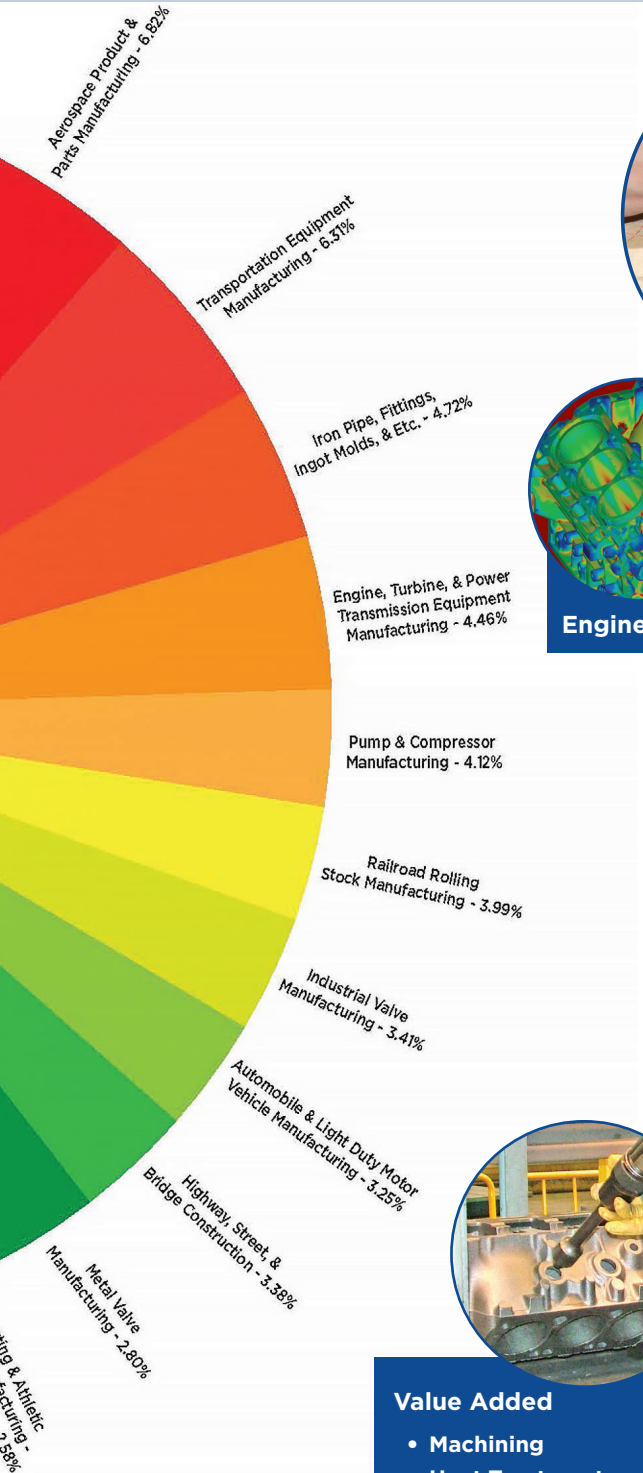
Ninety percent of all manufactured goods rely on metal castings.



Metalcasters Everywhere!

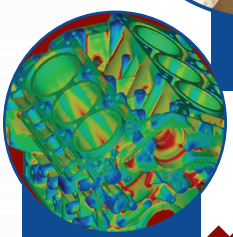
- 1,900+ Metalcasters
- 700 Ferrous; 1,300 Nonferrous
- Employ 200,000
- 75% Are Small Businesses With Less Than 100 Employees
- 2017: $31.5 Billion in Sales; 10.7 Million Tons Shipped

METAL CASTING SUPPLY CHAIN



Pattern & Tooling

Raw Materials & Equipment



Engineering

Metalcasting Facility

Value Added

- Machining
- Heat Treatment
- Parts Assembly

End Users of Castings

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