

MELTING POINT

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Building a Career in Metalcasting

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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 p. 20-23.

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LIGHTS. CAMERA. CASTING

Check out these cool videos online!

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What kinds of careers are in metalcasting? A new 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.

Careers in metalcasting include a lot more than just pouring hot metal. Watch this video from Oil City Iron Works in Corsicana, Texas, about its information technology department and how its systems are all connected on a network.



Check out what's it's like to work in an aluminum foundry. Batesville Products in Batesville, Indiana, makes castings for hospitals, law enforcement, 3D printing and lasers, scientific testing, and emergency devices, among many other industries.

Young GM Pro Shows Value of STEM Education

Amberlee Haselhuhn's resume reads like somebody twice her age. A researcher at General Motors' Warren Technical Center, Haselhuhn has a BS and PhD in materials science engineering and a BS in biomedical engineering. She is a recipient of General Motors' prestigious Boss Kettering award for outstanding innovation. She has also authored or co-authored 14 papers, given 7 conference presentations, and was honored with the '30 Under 30' award by *Manufacturing Engineering* magazine.

"You always want to work toward being the best you can be in terms of engineering and technical innovation," Haselhuhn said. "To be recognized for that, and as a role model for youth, was really rewarding."

Haselhuhn is paying it forward and showing the value of a STEM education.

Haselhuhn has worked with an all-girls First Robotics team and volunteers with the American Foundry Society doing foundry demonstrations at area schools. For her undergraduate and graduate degrees, she attended Michigan Tech and was active in the school's metalcasting program.

"I learned about Foundry in a Box activities at General Motors through a volunteer program (Team GM Cares), saw the Foundry in a Box activity on the list and I thought, I'll try it."

Getting involved with Foundry in a Box (a demonstration to bring the metalcasting

experience to young people) is a decision Haselhuhn, who's the first person in her family with an advanced STEM degree, doesn't regret.


"It kind of blew my mind away," she said. "Elementary-aged children to middle-school-aged children were making their own sand molds, watching metal being poured, and learning all about metalcasting, which was really awesome."

By doing what she has professionally, Haselhuhn is also a role model for young girls and women considering a career in STEM. That's not something she takes lightly.

"I think it's extremely critical for young women to see other young women doing STEM," she said.

"For me to be at these events as a recent college graduate, it makes it easier to relate with them and their experiences. I think it's important for them to see that young women are working in STEM disciplines and being successful at it."

Haselhuhn doesn't take her own success for granted; she knows that she's accomplished what she has thanks in part to being around other successful people.

"I've been surrounded by incredibly talented, smart and innovative people at General Motors and when I was at Michigan Tech. "There are so many intelligent people in the world," she said. "You're always hoping to improve your skills, innovate and to continue to be the best that you can be." 





TAKING *OFF*

A foundry teamed with a local patternmaker to create a casting for a rocket engine.

One of the first challenges product engineer John Nish and Wellman Dynamics (Creston, Iowa) faced during the design and manufacture of a high-pressure boost pump housing for a rocket engine turbo system was also a fundamental one:

How to manage a new alloy.

In the past, similar products were made of A357 aluminum. But for safety and environmental reasons, the choice was made to use F357, which subtracts beryllium.

“The beryllium really helps scavenge a lot of little problems out of there. It’s essentially the same alloy but that little tiny ion makes a lot of difference. That was one of the first challenges,” Nish said. “We’re changing from a standard alloy for high-pressure rocket design, changing from an A357 to an F357. We knew there would be challenges with getting properties, especially on castings with thick walls.”

In metalcasting, an alloy is a material composed of a metal and/or other elements. Different combinations of elements result in different properties, like strength or bendability.

But that was far from the only challenge Nish and his team had to overcome to deliver the 150-lb. aluminum casting to customer Aerojet Rocketdyne (Sacramento, California). Aerojet Rocketdyne is a billion-dollar company that serves the Armed Forces, NASA and commercial aerospace companies.

To overcome issues regarding the thickness of the casting and its metal flow, Wellman




Aerojet makes systems for spacecraft, like a 150 lb. bipropellant engine that fired for 15 minutes on NASA's MESSENGER spacecraft.

developed unconventional engineering methods. Liberty Pattern Company (New Liberty, Iowa) played a key role in this part of production. Nish said Liberty has a lot of experience with many configurations of castings. The foundry, meanwhile, has people in its own pattern shop and engineering group with experiences with various types of castings.

Together, everybody involved in the project looked at the mass and dimensions of the different parts of the component they would have to make. The product had to be completed quickly because Aerojet was competing with other companies for a contract.

The foundry started on this project in early-to-mid-2016 and the first casting was poured within seven months of a first team meeting. Within the next five or six months, the metalcaster was making production castings.

The production of a part with this level of intricacy was coordinated with Liberty, a company with whom the foundry has a longstanding business relationship. Ultimately, the team decided to use 3D printing to make the sand cores, which form the shapes



The product had to be completed quickly because Aerojet was competing with other companies for a contract.

in the casting.

Each challenge was met with the expertise of a team of professionals at all levels of development. The solutions enabled Wellman Dynamics to manufacture five additional high-complexity castings in the same program family. The willingness of Aerojet to work with Wellman to investigate and use novel processing methods in nearly every part of the casting manufacturing process was very importance. Continued collaboration between the companies is still producing solutions to implement process upgrades and design changes.





Making Pipe for Stadiums & Hospitals

At AB&I Foundry (Oakland, California), the walls do talk. The exterior of the McWane company's plant, stretching across nearly an entire block, memorializes the history and people who worked there in a vast, colorful mural. The founder's face and other past leaders' faces are there, but so are the faces of machine operators, maintenance crew, and HR staff. One of the final panels depicts a large hole blasted through the wall to show a painting of the operations inside.

AB&I general manager Michael Lowe said it symbolizes the company's decision to open up more to the surrounding neighborhood.

"To run a foundry in this modern era, you have to be open to the community, and create a community for your vendors, customers, and each and every team member," Lowe said.

AB&I Foundry was started in a backyard in 1906 and moved to its current location in 1940. Twenty-four years later, the Oakland Coliseum was built less than a mile away. As the years passed, the region became more urbanized around the foundry. All the more reason to beautify the outside.

Team Member Focused

AB&I doesn't have employees, it has team members. Lowe emphasized how important it is for the business to trust in and rely on workers from all areas of the foundry to innovate.

"We share all information, including financial in monthly meetings where we talk about what's going on. When there is an issue that needs to be addressed, we try to put people together who are closest to that and ask them to come up with a solution," said Lowe, who was first hired in human resources at AB&I. "There are no time clocks here. It's operated under trust and respect. I do one-on-ones with every team member. They understand the better the company does, the better they do.

"Better, faster, cheaper, safer," Lowe continued.

The result of this mantra and empowerment of individuals has been continuous incre-



mental improvements that have helped AB&I shave hours in processes, decrease costs, and improve casting quality, one experiment at a time.

AB&I holds frequent team building events and celebrations for accomplishments and record-breakers. Everyone, from machine operators to office staff, are encouraged to voice their ideas for improvement.

“Most of the ideas come from the operators—they are the ones sitting there watching the machine and how it is working,” said Dave Robinson, VP of plant operations. “The slurry for the pipe is just one of many innovations to try to reduce cycle times. Ten years ago our cycle times were 63 seconds and now they are 50 seconds. Shaving 13 seconds off a cycle when you are doing 600 cycles a day per machine and there are five machines running—it adds up.”

Historically, recruitment at AB&I has been through word of mouth, with many of the skilled positions filled from within through “home grown” team members. With little manufacturing in the Bay Area and a low unemployment rate, AB&I is adapting by providing an internal mechanical and electrical training program to teach those who have shown an aptitude for it and are already within the organization.

“Not everyone likes this type of work, but if they stay for a couple of years, they’ll stay for life,” Robinson said. “We all feel empowered and like we are making a difference. Our product hasn’t really changed—cast iron pipe has been around for more than 200 years—but it is made differently. Every day, every year we are thinking of ways to do things differently.

A comprehensive soft skills program has been launched for team leads, supervisors and managers. And the company occasionally brings in professors and outside instructors to augment training. The average tenure at AB&I is 19 years.

“We pay well, and we treat people well,” Lowe said. “We don’t have any secret sauce other than we have a good reputation.”





In the last year, AB&I has doubled down on that reputation by making a concerted effort to reach out to the community more than ever.

“We are trying to be completely transparent with the community and our neighbors,” Robinson said. “We are attending meetings and participating in programs and events—we’re not just focused on what goes on in our four walls.”

But as much as AB&I strives to be a good corporate citizen and employer, the bottom line is still the driving force that enables the foundry to provide well-paying jobs and maintain strong relationships with its customers.

“I work under the theory that low-cost wins,” Lowe said. “If you can manufacture it for less than your competitors, then you have a leg up. By getting all those little incremental improvements, you are driving down those manufacturing costs.”



The Plumbing World

Most of AB&I’s production and revenue is in plumbing. Its pipe goes into commercial buildings like stadiums, high rises, hospitals, schools and multi-family units. The West Coast market is expanding, and the foundry is seeing an increase in volume from multi-family and high-rise units. The ductile iron pipes are made out of 100% recycled scrap iron and steel. Ductile iron is impermeable to organic contaminants, so pipe made from the material is a safeguard against those contaminants--keeping them from entering the clean water inside the pipes.

With so much product dedicated to one market, Lowe said he considers himself to be more in the plumbing than metalcasting industry—although he acknowledges the influence of both. AB&I’s direct customers are pipe distributors, who sell to contractors,



making them indirect customers.

“The first thing installed in a large building is a soil pipe. It carries an emotional and strategic importance beyond its value,” Lowe said.

With the Oakland Raiders moving to Las Vegas and the Golden State Warriors building a new arena in San Francisco, the future of neighboring Oakland Coliseum is shaky. As the area becomes further urbanized, Lowe imagines the space could one day be filled with hotels and restaurants—hopefully filled with AB&I pipe. His vision for the future is to enclose all of the foundry—right now many areas are open to the outside—and hire Oakland artists to further cover the exterior with murals.

“I call it the art box. Oakland has a reputation for urban murals, so I picture a business woman or man sitting in their hotel looking out across the street and just seeing some cool art. We’ll fit into the neighborhood,” Lowe said.

For someone who, at age 14, declared he wanted to be either an artist or run a small manufacturing plant, the vision dovetails nicely with the young teenager's dreams.

“I have no idea where I got that from,” said Lowe, who comes from a family of attorneys and entrepreneurs. “But the second I showed up here, it felt like home.”





Employees are rewarded in many different ways for getting better at their jobs.

It's one thing to be born with a certain skill. But having ability will only take somebody so far, whether it's hitting a baseball or being the best foundry worker possible.

Leading metalcasters across the country recognize the importance of training their workers, and don't want their staff's skills get stale or old. While this benefits the metalcaster in obvious ways, it also shows the industry is committed to fostering growth in its employees. The employees benefit because the better they are at their jobs, the more they can advance in the field.

Oil City Iron Works Celebrates Its Workers

Oil City Iron Works (Corsicana, Texas) wants new employees to spend the rest of a successful career at the company. When someone takes a step toward that goal, Oil City Iron Works makes sure to mark the occasion.

Employees are required to wear hard hats in the foundry, and Oil City Iron Works designates new workers by having them wear green hard hats so they can be distinguished from the more-experienced staff members. Over this time, the new employees get on-the-job training, are required to progress in skill level, and are evaluated weekly for four weeks and then again at 90 days. If the new employee has successfully navigated those three months, Oil City Iron Works holds an informal short ceremony where the worker's supervisor and the vice president of manufacturing give them a blue hard hat as they "graduate" to become a full-time employee.

The switch from green to blue hats turned into a ceremony only recently. It happened when a woman who runs a green sand muller reminded plant superintendent/safety coordinator Cliff Bryant that it was her day to get a blue hat. At that point, graduates were just getting their new hats (and a pay increase) with little fanfare, but this new hire told Bryant to make sure her supervisor would give her the new gear. Bryant complied, and that got him thinking about what the blue hat means.

Bryant thought back to when he was in the Marine Corps when his battalion or company would have special ceremonies for promotions or other recognitions where the commanding officer would present the honor. He said those ceremonies didn't last long, but the formal recognition "made you feel good. It will make you feel like you've accomplished something."


And an idea was born for Oil City Iron Works.

C.A. Lawton Builds Career Path for Its Employees

C.A. Lawton is always encouraging its employees' pursuit of professional growth. So whenever the facility is eligible for a Workforce Advancement Training (WAT) grant, the company takes advantage.

In partnership with Northeast Wisconsin Technical College (NWTC), C.A. Lawton was awarded a WAT grant, which provides funds from the Wisconsin Technical College System (WTCS) to develop workers, improve productivity, and expand the partnerships between Wisconsin's technical colleges and businesses. Training under these grants focuses on occupational skills, and can include a combination of occupational, academic and employability topics or courses. C.A. Lawton teamed with the Corporate Training & Economic Development (CTED) department of NWTC to develop training on 10 topics.

In 2018, C.A. Lawton decided it had a large need for leadership training after workers on the foundry floor moved from production to supervisory roles. There's even some "train the trainer" training, which helps the company train new and current employees that's part of a new on-boarding program being launched. Additional training will be on computers and modern office technology for workers who are more familiar with the shop floor. C.A. Lawton is also sending 15 employees for green-belt certification in lean manufacturing.

"I think the cool thing about the WAT grant and the leadership training is so many of these people were promoted from within because they were good at what they were doing. They were good at their job task," said Cathlin Stuntz, director of operations. "These training classes we've chosen are very specific to help (the new supervisors) understand the difference between being their buddy and their co-worker and now being a leader and how to do that well. That's awesome." 



Employees at Oil City Iron Works take part in a ceremony to receive their blue hats.

CASTINGS DO THAT?

Castings Create Waterfalls for 9/11 Memorial



Approximately 11,500 8-9-in. needle-shaped castings were used to create the waterfalls at the 9/11 Memorial and Museum built in the footprints of the fallen twin towers of the World Trade Center. The thin castings line the top of each 30-ft. waterfall and create the thin streams of water cascading down all sides of the pools. Each memorial reflecting pool is an acre in size and surrounded with swamp white oak trees.

The castings were produced out of 316 stainless steel via the investment casting process by Image Casting/Masters in Metal Inc. (Oxnard, California).

The 9/11 Memorial opened on the 10th anniversary of the 9/11 attacks in a dedication ceremony for the victims' families and then opened to the public on September 12, 2011. **MP**



UW-M Student's Impactful Internship


Kevin Slezak is a senior attending the University of Wisconsin-Milwaukee, majoring in physics and materials engineering. Throughout his studies, he has had some exposure to metalcasting, and the senior project he chose to work on with MetalTek International's Investcast division gave him even more experience.

Slezak's knowledge and interest in investment casting (a metalcasting process in which a wax or plastic pattern is used) greatly expanded during the summer of 2018. He spent several months as a process engineer intern at investment caster Signicast Corporation. His time was split between the headquarters in Hartford, Wisconsin, and its former headquarters in Brown Deer, Wisconsin.

Several process engineer interns worked at Signicast, and they spent the first several weeks rotating through all the processing positions in the Hartford facility. This allowed them to obtain a quick but detailed picture of the beginning-to-end production process. Through the remainder of the summer, each intern was assigned a project that was to be their primary focus, and spent their remaining time assisting the process engineers. This work included metallurgical testing and data analysis.

Slezak was assigned two summer projects. The first project involved testing the com-

pany's relatively newer optical emission spectrometer which had equipment and software that other spectrometers didn't. He investigated and tested the new features to ultimately determine if the machine was working as designed. Completion of the project meant better quality control for the company's alloys in the future. The second project focused on exploring applications of ultrasound to processing. This project was very open ended, leading to extensive background research and culminating in a presentation on various applications given to department heads, as well as the CEO.

"Signicast helped me obtain a scholarship at the end of my internship, leading to an invitation to the Investment Casting Institute's technical conference," Slezak said. "My university's relationship with (the Foundry Educational Foundation) helped make my trip to the conference possible, allowing me to network with experts in the field and learn more about the investment casting industry." 



Kevin Slezak spent several months as a process engineer intern at investment caster Signicast.

METALCASTING UNIVERSITIES & SCHOLARSHIPS

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, Michigan

Georgia Southern University
Statesboro, GA

Instituto Tecnológico De Saltillo
Saltillo, Coah, Mexico

Kent State University
Kent, OH

Michigan Technological University
Houghton, MI

Milwaukee School of Engineering
Milwaukee

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

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 Michigan
Ann Arbor, MI

University of Northern Iowa
Cedar Falls, IA

University of Wisconsin—Madison
Madison, WI

College Scholarships
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Visit the Foundry
Educational Foundation at:
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Milwaukee**
Milwaukee, WI

**University of Wisconsin—
Platteville**
Platteville, WI

Virginia Tech
Blacksburg, VA

Western Michigan University
Kalamazoo, MI

**Worcester Polytechnic
Institute**
Worcester, MA

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 Trade

Careers: Post High School

- Molder, Machine Operator, Pourer, Crane Operator: \$17+/hr
- Lab technician, Quality Assurance, Welder, Furnace Operator: \$19
- Patternmaker, Maintenance Mechanic: \$22+/hr
- Electrician: \$24+/hr

Careers: Post College

- Molding, Melt Superintendent: \$76,000+/year
- Metallurgist, Quality Assurance Manager, Facilities Manager: \$85,000+/yr
- Engineering Manager, Plant Manager, HR Manager, Controller: \$100,000+/yr
- Sales Manager, Technical Director: \$120,000+/year
- VP, President: \$175,000+/yr

Benefits

- 98% of U.S. foundries offer health benefits
- 90% offer retirement plans
- 83% pay bonuses

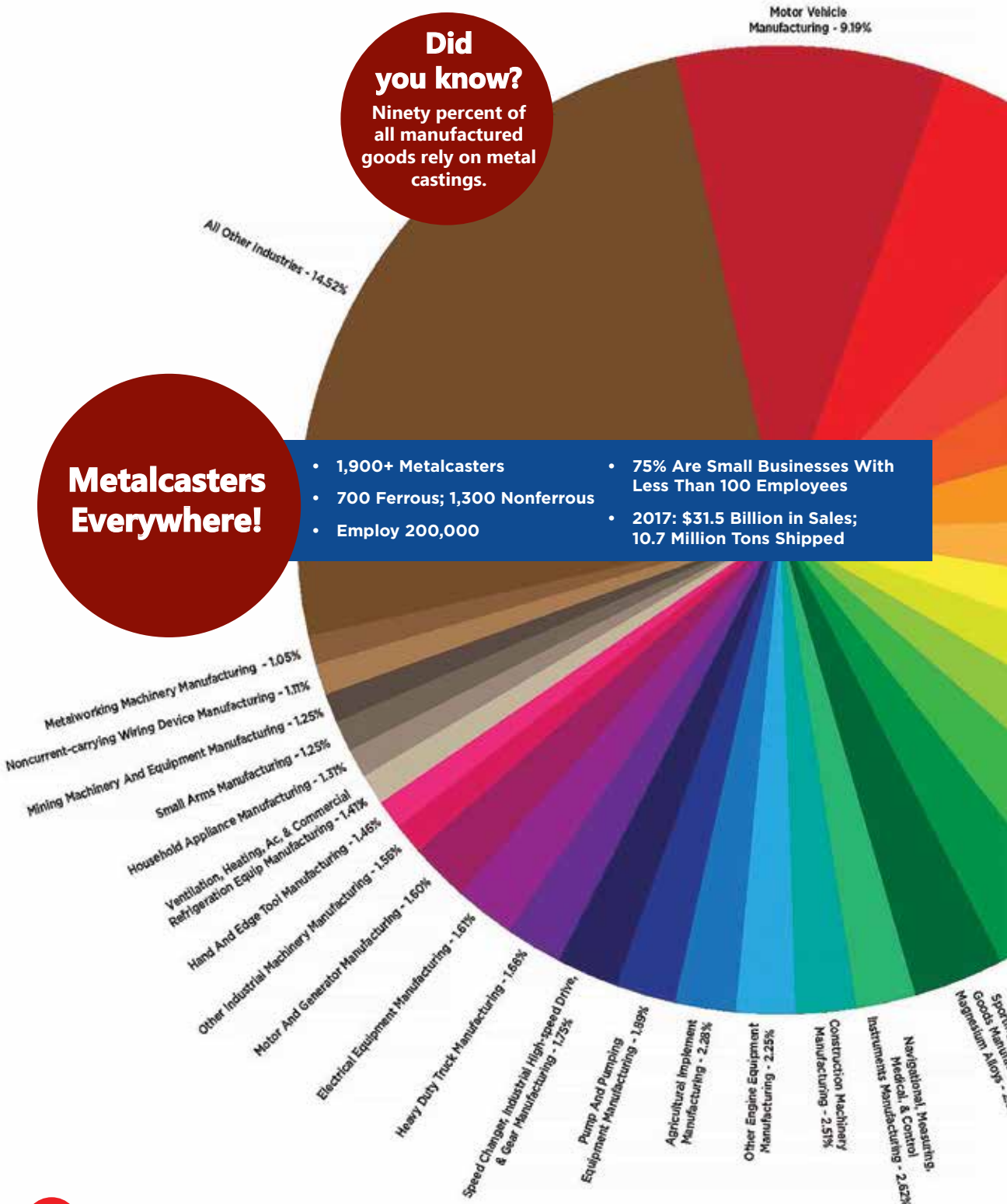
WHERE DO CASTINGS GO?

Did you know?

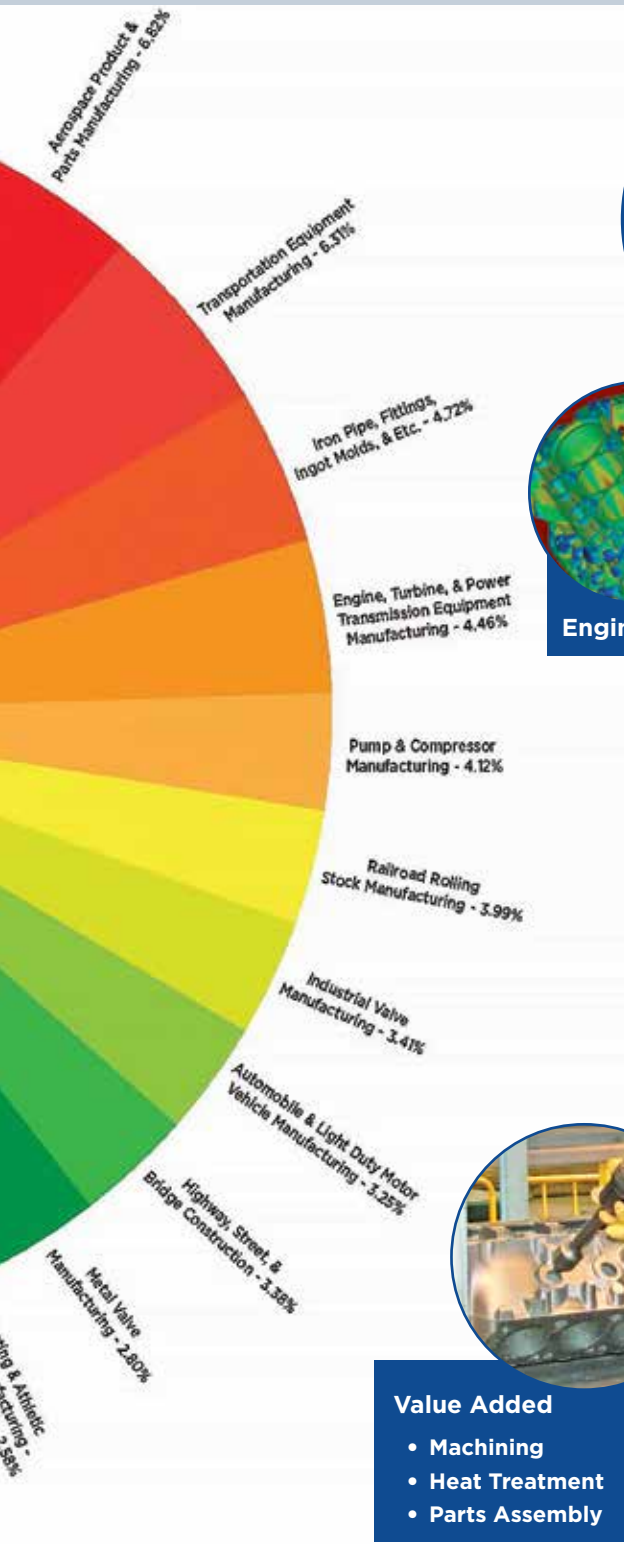
Ninety percent of all manufactured goods rely on metal castings.

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



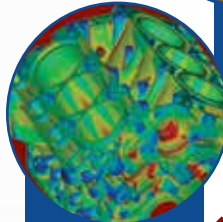
METAL CASTING SUPPLY CHAIN



Pattern & Tooling



Raw Materials & Equipment



Engineering



Metalcasting Facility



Value Added

- Machining
- Heat Treatment
- Parts Assembly



End Users of Castings



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