ISSUE 4—SPRING 2019

PARTBUYERS AUTHORITY

OIL/GAS/MINING CONSTRUCTION

This issue discusses the latest technologies in regards to metal part manufacturing for the oil/gas/construction industry. The authors in this issue detail the high level of quality required for their oil/gas, mining, and construction customers. Buyers of parts will appreciate how they describe specifically what happens on the production floor to make these high performing complex parts.

MARKETING OPTIONS

DEMANDING ENVIRONMENTS BENEFIT FROM ADDITIVE MANUFACTURING TECHNOLOGIES

The opportunities on the manufacturing floor are changing and those in the toughest of all industries have much to gain. Smart technologies, IoT, 3D printing, and scanning all play a role in developing and moving higher quality parts into production faster. The transition towards more advanced manufacturing methods that can adapt to change, as your production changes is everywhere. This issue discusses many of these technologies that are being deployed on today's production floors specifically for parts for the oil, gas, mining and construction industries.

Our foreward for this issue is by Will Shambley, an additive manufacturing consultant with New England Foundry Technologies. Will is active in directing the deployment of many of these technologies and explains their latest uses, especially for large part production.

With each issue we strive to provide exposure to companies who are helping to advance the capability of American manufacturing. This is a collaborative environment – which means you have a voice too. Have a technology or type of part that you would like to see discussed...simply **complete our form at partbuyersauthority.com.** We would appreciate hearing from you and understanding the material and technology questions you have regarding part manufacturing.

I trust that this issue of the Part Buyers Authority will be helpful in understanding the technologies that can benefit your part's production—today.

Barb Castilano
Owner, Marketing Options
Founder/Publisher, Parts Buyers Authority

MARKETING OPTIONS

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FOREWARD

NEW ENGLAND FOUNDRY TECHNOLOGIES

WILLIAM SHAMBLEY
President, NEW ENGLAND FOUNDRY TECHNOLOGIES

The Importance of 3D Scanning and Reverse Engineering FOR PUMPS AND MINING

Mining, the pumping of water, and agricultural uses are some of the oldest industrial applications. These industries are the home to literally thousands of years of castings. Companies who supply cast parts for pumps, mining, and agriculture have collections of drawings, patterns and tooling that date back, in some cases, for centuries. There are companies that measure the value of the patterns they are warehousing in the billions.

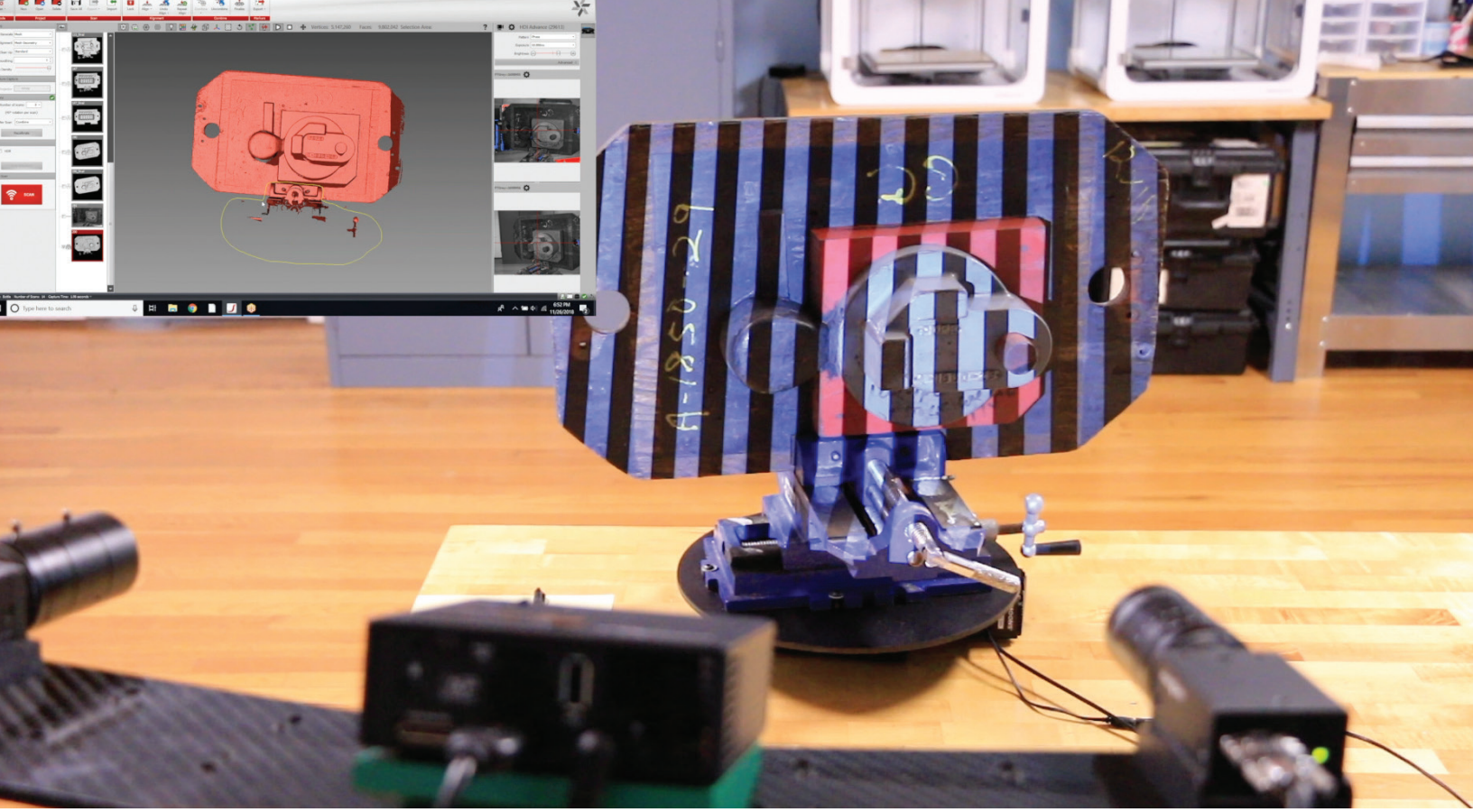
Many of these components must be replaced with an exact duplicate, in others there exist opportunities to enhance the solution by using new designs or alloys. For castings that were made so long ago, there are frequently lost patterns, drawings, etc – and the only thing left is the casting that needs to be replaced. In the case of paper, mining, and wastewater – these parts may be very large, and they may need to be manufactured in advance of failure.

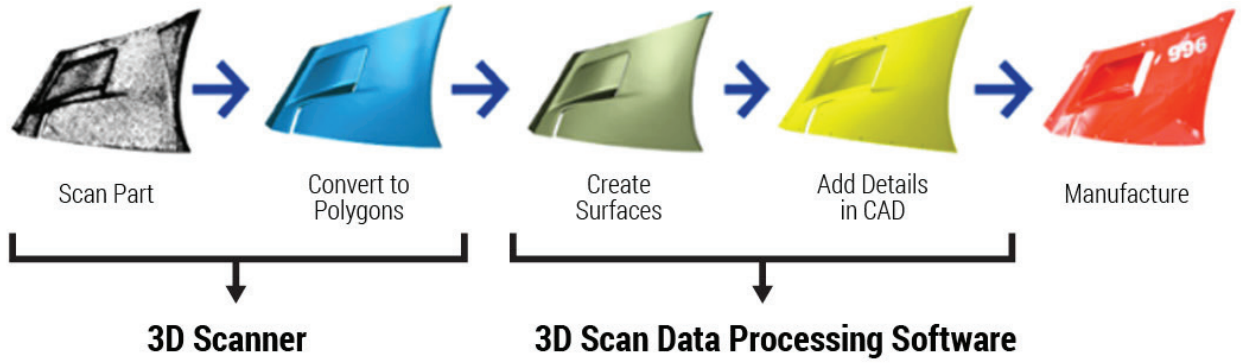
3D Scanning, and Reverse Engineering Services have therefore flourished, and there are many well documented case studies showing the standard applications of scanning patterns to reverse engineer them when CAD isn't available, and for scanning castings to reverse engineer replacements.

The steady evolution of technology has brought CMM quality 3D scanning and the software tools into price ranges where foundries can (and many already have) purchase them. Data acquisition of a pattern board, for something like a Hunter machine, can be 4 or 5 minutes with a very affordable system. These tools can be used for tasks such as:

- Archiving old-obsolete patterns
- Inspection of patterns prior to use, or for wear during long runs
- Documentation and quantification of surface defects, shrinkage porosity, hot tearing, etc.
- Inspection of other equipment, evaluation of corrosion, wear, machining defects, etc.

Full inspection of first articles with 3D Scanning, comparing scan data directly to CAD sets a production facility up so that they can perform Scan-to-CAD QC on future production parts. Foundries have reported up to 75% reduction of inspection costs by making the switch to 3D scanning tools.





Scanning tools can aid foundries in many applications beyond these, especially when communication with customers can be open. Casting design questions can be addressed with real quantitative data: “What is the volume of shrinkage defect?” “How much hot tearing?” “How far out of plane are the surfaces?” With quantifiable data, and some investigations through casting simulations, tooling can be modified to eliminate many problems. This learning isn’t just for sand casters, as there are case studies and papers showing the utility of using 3D Scanning as a tool for process diagnostics in die casting, investment casting, forging, stamping, and others.

Having the right tools on hand for inspection, quality control, diagnostics, archiving, and reverse engineering allows a foundry and their customers to capture data and optimize process for mutual gain.

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ROBOTIC 3D PRINTING FOR METAL CASTING

Hazleton Casting Company

TONY BADAMO
President & CEO
HAZLETON CASTING COMPANY

Additive Manufacturing (AM) or 3D printing is an exciting technology that creates solid objects from a 3 dimensional CAD model. 3D sand printing (3DSP) falls under the Binder Jetting category of additive manufacturing. Molds or cores are produced by jetting a chemical activator over a bed of blended silica sand and dry acid binder to create a mold or core in accordance with the 3D model design. The mold or core is constructed one layer at a time as the jetted activator reacts with the dry acid to create a chemical bond joining one particle of sand to another. Computer software manages the construction process by controlling the deposition of the activator only where needed. Upon completion, the mold or core is removed from the print table and any blended sand that has not been treated with the jetted activator is removed from the build envelope. In some cases, this untreated blended sand is collected and recycled for reuse in subsequent prints.

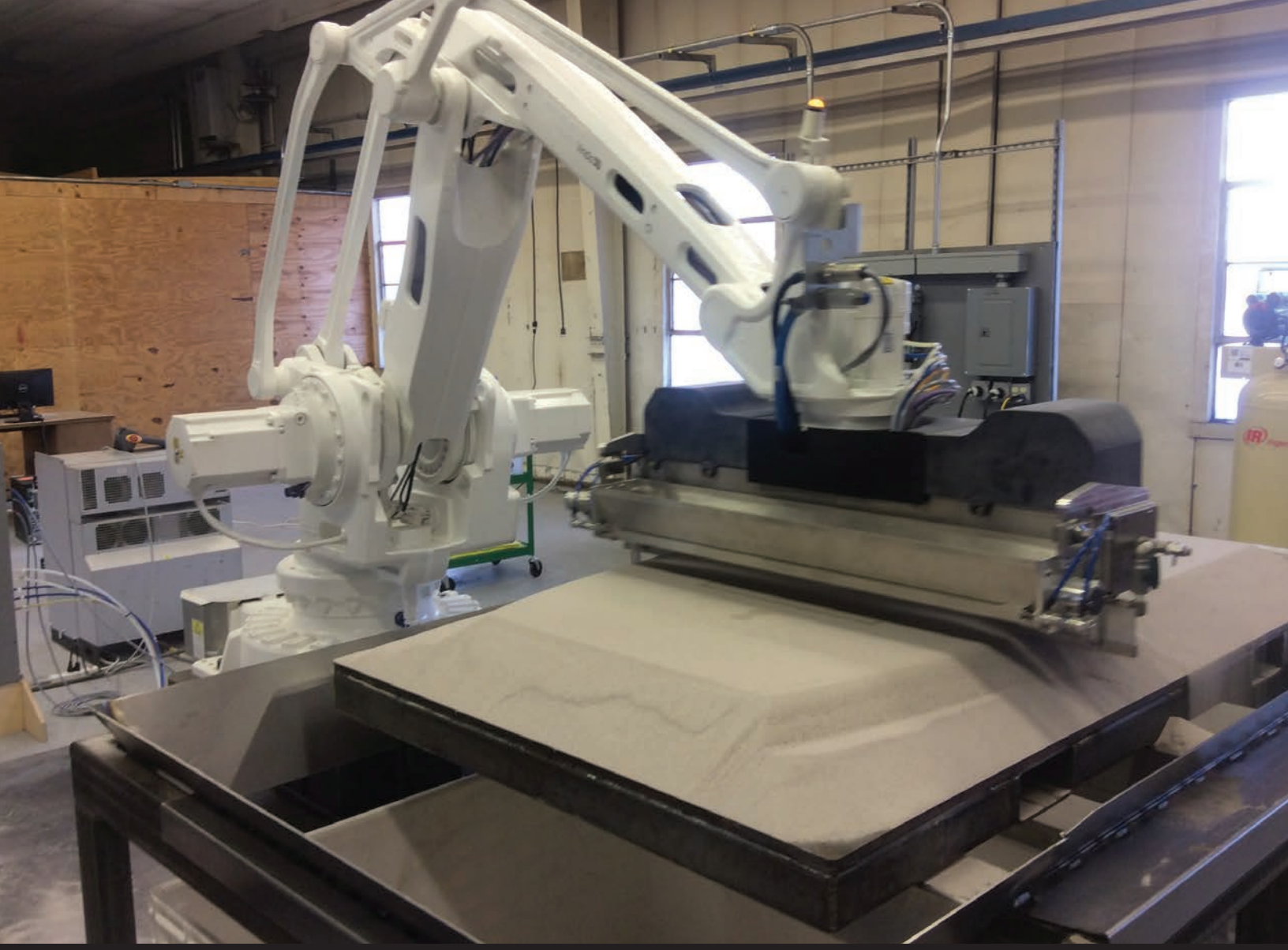
As with any of the other well known and understood molding and core making methods, 3D printing can be an effective solution when this technology is properly applied to the manufacturing problem. The additive production methodology produces sand molds and cores directly from a computer generated model thus eliminating the need for patterns and coreboxes. This makes the additive method of mold and core production uniquely suited for casting production when shortened delivery cycles are needed or when fixed tooling is not available.

With Additive Manufacturing receiving so much attention, it is easy to get caught up in the excitement. It is important to understand when AM is appropriate. This is especially true for 3D sand printing. While there are many advantages to 3D sand printing, the incorrect application of this technology can add considerable cost without a realized benefit.

Prototyping and design confirmation projects are very often the first thing that comes to mind when the subject of 3D sand printing is discussed. In many cases, sample pieces can be produced and tested in less time that is required to produce conventional tooling. Additionally, subsequent product design modifications can be effected in days through a revision to the digital files as opposed to time consuming and costly modifications to wood patterns.

3D sand printing is also widely recognized as an effective solution for timely production of castings that are needed in very low quantities or single use requirements. In these situations, the cost of fixed tooling can be difficult to justify from a cost and lead time perspective.

It should also be noted that 3D sand printing does not need to be a stand-alone solution. Perhaps 3D sand printing offers the most benefit when this technology is integrated with conventional foundry practice. Cost savings can be realized when utilized in conjunction with traditional molding methods. Additionally, sand printing molds and cores provide a near infinite amount of design freedom to equipment designers and engineers. Conventional foundry processes often limit available geometries due to the need for tooling to be constructed with



Robotic 3D Printing

draft to facilitate separation of the sand mold or core from the tooling. Sand printing can eliminate the need for complicated and costly core making equipment needed to accommodate design geometries with undercuts or back-draft conditions. The hybrid approach can reduce cost by eliminating the need to print the entire cope and drag.

Working with a foundry experienced with sand printing cores and molds is important for a successful adoption of sand printing applications. Integrating 3D printing with traditional foundry operations in a hybrid casting process combines the best of both practices. This is particularly true when planning production strategies for complex castings that are rich in geometric features or have geometries that require regular modification to accommodate specific operating requirements. A foundry that is intimate with 3D sand printing can identify and develop cost effective casting solutions for you.

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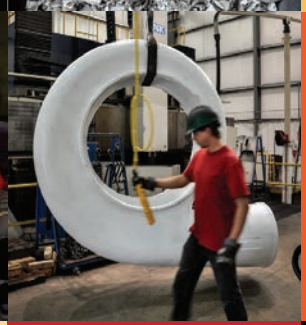

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Aluminum Casting Benefits for Construction, Agricultural & Mining Markets

DAVID SEILKOP President
EPCOR FOUNDRY, Division of Seilkop Industries, Inc.

The aluminum casting market has become a viable alternative solution in many industrial markets. Understanding how aluminum can replace traditional iron and steel in your product line is only part of the equation. The other part is understanding how they will be produced to enhance part longevity and reduce costs.

The aluminum casting market has enjoyed substantial growth in many automotive sectors and will continue to do so based on current trend analysis. Simply, aluminum alloys are proving a worthy alternative to conventional materials - iron and steel at a rapid rate. This growth is now over flowing into other sectors as well, namely construction, agricultural and mining industries on a global basis.

It is easy to understand the attractiveness of aluminum castings to these heavy-duty industries. Aluminum castings have always been desired because of their high strength to weight ratios compared to their iron and steel counterparts. Improving fuel economy, battery range, safety and overall driving performance has led to unprecedented growth. Manufacturers no longer feel tied to one alloy and one approach and are eager to adopt a multi-material design that meets their needs.

The automotive market mandates to increase fuel efficiency while limiting carbon dioxide emissions has been a key driver for aluminum casting growth. Therefore, aluminum castings are becoming vital in a wider range of automotive parts including safety critical components, engine cylinders, engine blocks, gear boxes, engine and transmission bracketry and hydraulic applications. These parts, of course are also in other important transportation industries as well, most notably construction, agricultural and mining.

Limiting carbon dioxide emissions is not just an automotive mandate; it is becoming more important to all industries. Aluminum is proving to be an ideal replacement for heavier metals including iron and steel, specifically because being lighter weight reduces emission of carbon dioxide into the atmosphere. Additional aluminum casting benefits include the ability to mold to a nearer net shape and they can be produced in high or low volume production runs more cost effectively.

Manufacturers of high performance equipment for the oil, gas and construction industries benefit from better performing aluminum alloys and cost efficient parts that are as sustainable as other materials. Aluminum castings are becoming vital to all industries, but especially those that only thought steel or iron could produce the types of parts they required. In addition to a part that is lighter in weight, aluminum is considered to be the best choice for the environment when compared to iron and steel.

Aluminum castings can be produced to very tight tolerances in different methods ranging from aluminum sand casting, high/ low pressure die casting, permanent mold and investment casting. Understanding the right process for your part is critical, as many of these casting methods can reduce machining as well as other post processing operations, thereby making it also an economical method for the manufacture of heavy-duty construction, agricultural and mining equipment.

The growth of aluminum castings world-wide will naturally lead to additional research and

Robotic automation

development. This development will lead to new applications for aluminum castings. Anytime a market is seeing this much growth, you can expect to see it carry over into other markets segments as well.

It's no surprise we are seeing manufacturing technologies designed to produce castings with a higher precision, at reduced costs. Additive Manufacturing (AM) trends have created enormous excitement. We expect to see enhanced automation growth throughout the entire foundry, ranging from PLCs, robotics, and software to handle the demand for this growth.

Automation is paving the pathway to safer and more efficient production to meet the growing capacity demands for aluminum castings.

The role that robots and smart technologies are playing to safely pour, handle and finish parts in today's aluminum foundry cannot be understated, especially in our tight labor market. Synergized-systems as described in Industrial 4.0 and Internet of Things (IoT) have arrived and provide the flexibility and reliability needed to handle the growth with precision and repeatability.

Industrial 4.0 is all about putting your data to work to improve the decision-making and reduce

errors during the production process. From reducing energy at the melt deck to producing castings that need less machining, today's aluminum foundry is a source of inspiration when it comes to operating under lean manufacturing principles to reduce waste and increase results.

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INTEGRATED DIGITAL CASTING

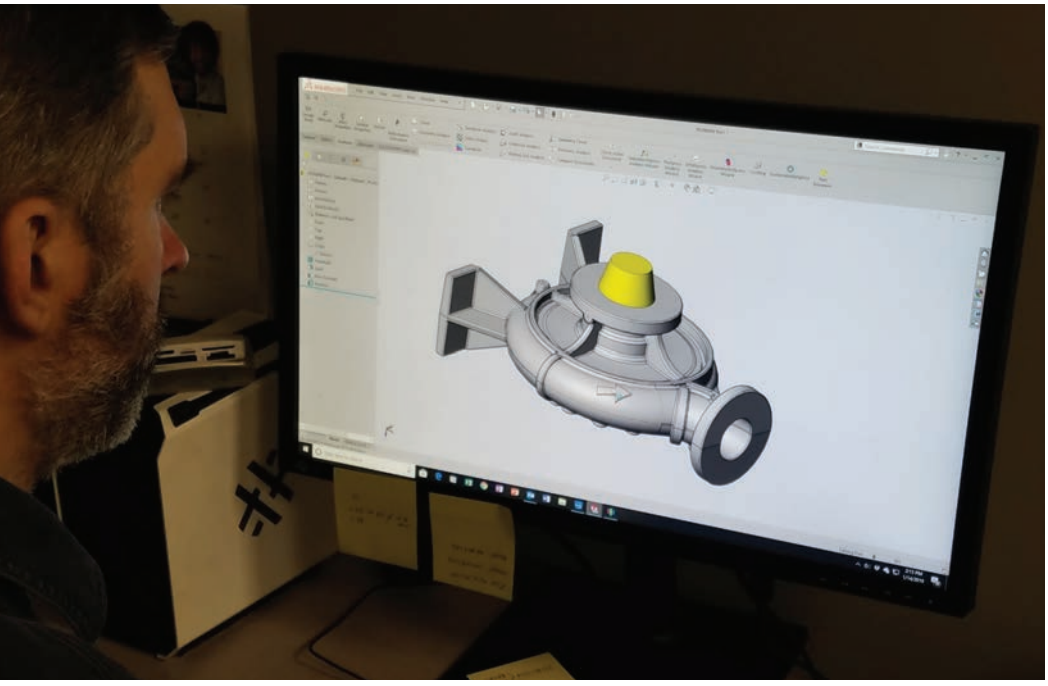
ODIN METAL CASTING REDEFINED

MARTY RENK
ODIN GENERAL MANAGER
ODIN CASTING COMPANY

Digital Casting (DC) is the integration of computer driven technologies to manufacture quick and cost-effective castings. Partnering with an integrated DC service provider who offers a full complement of DC technologies is critical. Oftentimes DC technologies are piecemealed by using multiple vendors, which ultimately can lengthen leadtimes, add costs and cause headaches.

Specifically, DC is the application of both general manufacturing and foundry specific technologies, listed below, to make a casting.

- Solid Modeling
- Fluid Flow Simulation
- Solidification Simulation
- 3D Printing
- Laser Metrology

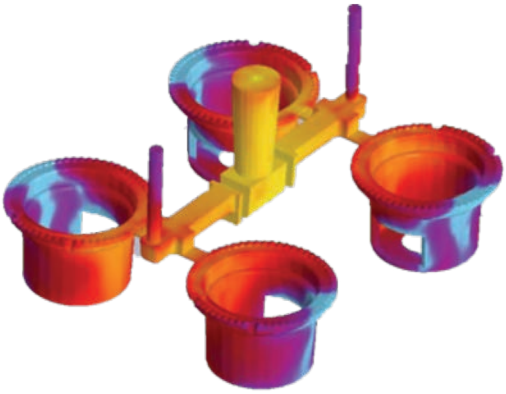


SOLID MODELING

The foundation of a DC is supported by a Computer Aided Design (CAD) solid model. In a generic sense, a solid model is a 3-dimensional computer representation of an object. In the casting world, a skilled engineer uses CAD software to build a dimensionally precise 3D representation of a casting. Without a solid model it is impossible for the casting manufacturer to apply any digitally based manufacturing and/or foundry technology.

FLUID FLOW SIMULATION

Foundry simulation, specifically fluid flow and solidification simulation is used to ensure that DC's are made quickly and cost effectively. Fluid flow simulation calculates how molten metal flows into the mold cavity. From this analysis, a foundry engineer can measure metal velocity, temperature and pressure. Knowing this information allows the engineer to optimize casting manufacturing methods and minimize the potential for casting defects.



SOLIDIFICATION SIMULATION
Like fluid flow simulation, solidification simulation allows a foundry engineer to predict the location of casting shrinkage porosity. Understanding the location of casting porosity allows the foundry engineer to design and optimize the casting's manufacturing method.

In short, foundry simulation can help significantly reduce casting lead time by making design "mistakes" on a computer rather than the foundry production floor.

3D PRINTING
Traditionally, foundry tooling has been made by skilled craftsmen, called patternmakers, using various wood working equipment and tools. Unfortunately, over the past 10 years the number of patternmakers entering the trade has declined.

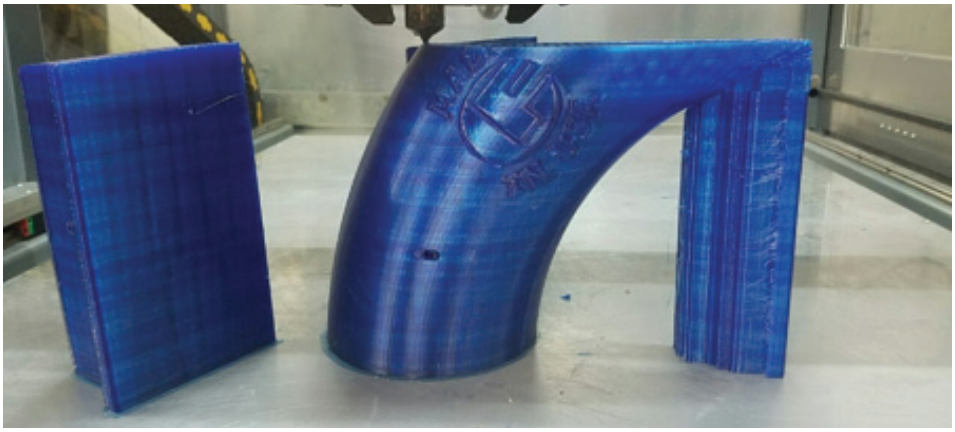
In recent years, the application of 3D printers has been used to fill the patternmaking skills gap. Fused Deposition Modeling (FDM) is a 3D printing technique which builds an object by extruding plastic through a computer-controlled machine. 3D printed tooling offers several advantages over traditionally built patterns; improved speed, reduced cost, design optimization and moderate tool life.

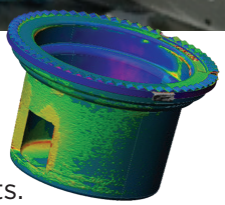
1. Improved Speed
3D printers can run around the clock. Some FDM printers use multiple extruder heads, thereby printing parallel and reducing print time.

2. Reduced Cost
FDM printers are relatively low-cost machines and simple to maintain.

3. Design Optimization
3D printing allows a casting design to be adjusted quickly and cost effectively. In some cases, designs can be tweaked, 3D printed and recast in as fast as 24 – 48 hours.

4. Moderate Tool Life
Many domestic foundries would be considered job shops who produce low to moderate volume/high product mix castings. The life of an FDM 3D printed tool can offer a life ranging from one mold to thousands of molds.





LASER METROLOGY
Laser Metrology, or laser scanning, uses light to measure objects.

When applied to a DC, laser scanning is used to compare the DC against a CAD solid model. The laser scan data is overlaid to the CAD solid model and the foundry engineer can compare dimensional discrepancies in the DC. A color map is used as a visual reference to show the DC's dimensional accuracy.

DC's offer many advantages to the casting buyer and casting user. DC's can be used for rapid prototypes, supporting a legacy product line, short production runs or provide the foundation for a first article casting.

A key consideration when looking to procure a DC, however, is finding an integrated DC technology service provider. Piecemealing DC services by using multiple vendors, who don't offer a complete solution, can prove to be troublesome. A fragmented approach can foster finger pointing when things don't go as expected, can lengthen lead times, and ultimately add cost to the casting.

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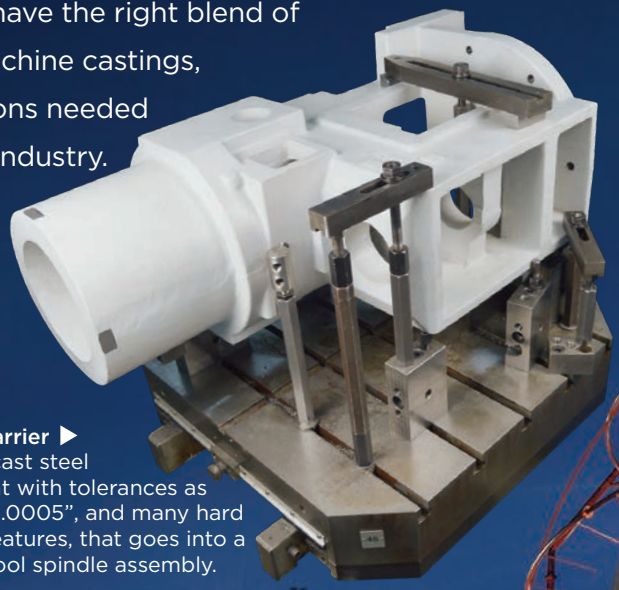

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Meeting the Challenges of Part Machining for the Volatile Oil/Gas/Construction Industry

DYSINGER INCORPORATED
GREG DYSINGER
Vice President of Sales & Marketing
DYSINGER INCORPORATED

While many will refer to the astonishingly enormous size of many of the parts used in the oil/gas, mining and construction industries, it is the environment that these parts need to perform in that is truly amazing.

Parts used in earth moving vehicles in construction and mining operations, and on oil rigs must perform in the very harshest of environments. In a nut-shell, these are expensive operations with a highly trained work force that depend on very positive outcomes.

Some of the same quality standards that are important to other demanding industries such as aerospace apply to this tough industry as well. ISO and other certifications are equally as critical for safety, quality control, and continuous improvement.

This industry relies heavily on all kinds of metals and processes including castings of many different alloys, as well as forgings, stampings, and weldments.

The oil/gas/mining industry in particular is riddled with volatility. While this industry certainly feels much healthier than it did a year ago, it is still a difficult one to predict. There always seem to be headwinds between an over-or under-supplied market. While hardly the easiest of markets to be successful in, manufacturers that do well are the ones you want to pay attention to. Those that thrive in this industry have typically demonstrated capabilities that are flexible to your needs no matter how or when you need them.

Collaborative Relationships

Most of the parts we deal with for this industry are complex, require special attention to machining, and importantly – are not mass produced. This means producing the parts one or two at a time—only as needed. Many manufacturers would find producing parts one or two at a time cost prohibitive. To make parts in low volume takes both special capabilities and a process flow that ensures high quality and efficiencies.

We also recognize that for one set of parts, we may be asked to

Large fabrications and castings can be accommodated on any of our (2) palletized 800 MM CNC horizonal mills or any one of our (4) large CNC Devlieg jig mills that travel as long as 96". This custom fabrication was originally designed to mix rubber for the tire industry – providing precision of .001 on most of the critical features. Additionally, tight surface finishes and tolerances are held regardless of the 2500-pound size and the hard-stainless steel surface. For repeated projects, Dysinger can use the "lights out strategy" on these pallets to help reduce overall customer costs.

perform additional machining, however when the industry gets tight, we may only be requested to perform one process. This is the type of flexibility required to perform well in this volatile industry. Additionally, being able to machine large parts as and when needed is key as in this industry changing production requirements are the name of the game.

Reverse Engineering

When production changes hands, it is not uncommon for patterns and drawings to be lost. We often find that requests to reverse engineer a part are not simply to replicate that part; rather to make that part better. Because of this both strong engineering skills alongside industry experience are required.

Project Management

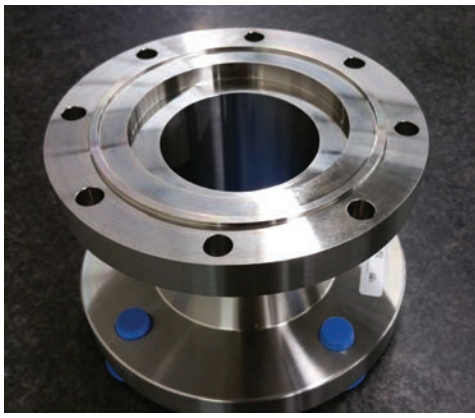
The volatility in this industry makes forecasting, delivery, change orders, controlling project progress, and managing changing expectations – all that much harder. The only way to manage this complex process is with Project Management.

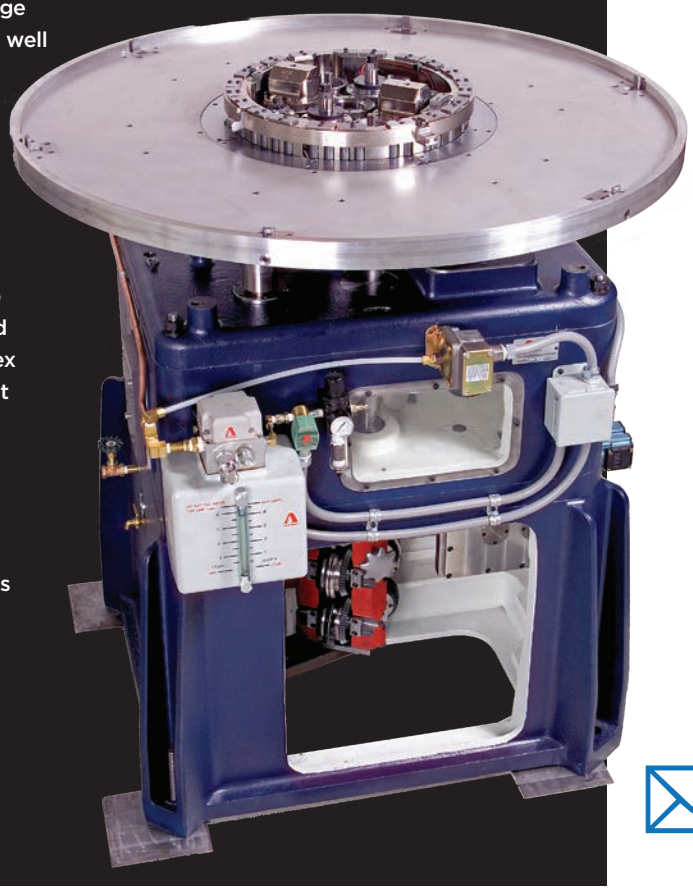
Project management in manufacturing is what ultimately makes companies successful in this industry. Producing complex parts, to tight tolerances in a variety of materials—one at a time— takes careful coordination. But the benefits pay off for all parties in very quantifiable ways.

- Progress tracking – being able to track and control a part's progress quickly identifies potential delays and the steps to mitigate problems.
- Risk Management – understanding potential risks and having a plan to handle them. Preventing downtime means taking care of machines that break.
- Continuous Improvement – systems in place to learn and improve from past project and mistakes.

All in all Project Management provides the ability to increase flexibility while decreasing waste.

There is a whole lot more to this industry than just fabulously large complex parts that work in the most demanding environments. Dysinger takes great pride in improving parts that operate better and safer for the workers that depend on their performance.





This machine makes heat exchange material for refrigeration units as well as air conditioners. The original OEM was no longer available when it came time to put significantly more material into every air conditioner. With limited technical data and drawings, we reverse engineered this large machine to completely manufacture new and improved versions of this complex piece of equipment. We also built the patterns for the castings, manufactured all components, assembled and tested complete machines, ready for install at our customer's facility. We worked hand-in-hand with our customer's manufacturing team— working seamlessly together, just as the precision parts of the Spine Fin Machine do.

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WHAT BUYERS NEED TO CONSIDER

R&M SALES

MELANIE JOHNSON Sales Manager
R&M Sales

I was 22 years old when I began working at the same local foundry where my grandfather worked for 34 years. It was hot in the summer, cold in the winter, and very dirty all year round. For 7 years I sorted good castings from bad. I ground and sanded castings and also punched, pressed, painted and gauged castings.

After a promotion to customer service, I quickly learned that this was my opportunity to create a difference in someone's life by making their job a little easier. From day one I adopted the philosophy—the good of the customer is equal to the good of the foundry. I always focused on educating the customer on how the foundry operates, as well as educating my co-workers on our growing customers' needs. Later, my move into outside sales, and representing many foundries and plastics molders provided me with unlimited ways to help part buyers, as I was no longer limited to "selling" one alloy or process. This put me in a unique position to only be driven by the directive and needs of the customer.

From working on the foundry floor to traveling the globe assisting some of the world's largest manufacturing companies with part making decisions, I have insight that would be helpful to anyone going through the process of figuring out the best material and process for your part.

There are several types of buyers; those who have been purchasing castings for years and know as much about them as any foundry, those who have limited knowledge of the process, and those who have just begun their careers in purchasing. My hope is that this article will provide each type with some information they may not have known.

Today's metalcasting industry is on one hand very much the same as it was years ago, and on the other hand very different. While the basic process of how a casting is made hasn't changed, however, the way in which it is achieved has been improved over the years through advancements in technology. There are foundries that still produce castings manually and there are foundries which are totally automated. Finding the right foundry for your needs is key and understanding your needs isn't always clear.

One of the most common questions I've heard as of late is – why customers may be experiencing a consistent decline in service, quality, and delivery from foundries they have been using for years.

There are many reasons for this and it would be difficult to trace it back to one thing, but some of the issues surrounding metalcasters and to some degree, manufacturing in general is:

LABOR

The skilled workforce has changed. In a time when molds were made manually, you had John who knew exactly how each part needed to be made. He did it consistently with an eye for detail, took great pride in his work, and could make 100+ molds per day.

As automated machines increased efficiencies (70 - 400+ molds per hour) and replaced manual operators, the need to train more operators, diminished. As a result, foundries have either greatly reduced their manual molding or eliminated it all together. Automatic molding machines are each limited to the size of patterns/parts they can use to produce castings. If a part is not compatible with the machine, or the quantities are too low (making it not economical to produce), then manual molding is still the best process.

Today's labor force however, has limited interest in learning this skill when they can just easily push a button and make molds. From a finishing standpoint, the biggest bottleneck for most foundries today, the same applies. While many foundries are making capital investments to keep temperatures in the foundry moderated and dust down, some are still hot, cold, and dirty. This environment does not appeal to today's workers, therefore, finishing all the castings a foundry produces, falls on the few.

Some foundries have integrated robotic grinding machines into their finishing departments to alleviate this bottleneck. However, this is a huge investment that many foundries cannot afford. Additionally, it cannot

accommodate every part a foundry produces. Therefore, labor still ends up being the number 1 driving force for lead times.

LOSS OF METALCASTERS

It is no secret that overseas manufacturers have done a great deal of damage to the domestic manufacturing market. In the early 2000's when many customers were faced with re-tooling overseas as a means to remain competitive, the vast majority of domestic foundries were left with huge voids in their backlog.

Many couldn't replace the lost work and shut their doors. Some were sold to holding companies and remained profitable, but many were closed due to a shift from customers' satisfaction to shareholders' and as a result service declined, prices increased, customers left, and profits fell. Conglomerate foundries were consolidated, or divisions closed due to lack of profitability or changes in business models. Multibillion-dollar companies purchased foundries to produce their products by controlling pricing and lead times. The great recession of 2008 also claimed many domestic foundries. Even after all of the events of the last 20 years, there were those that clung to life as best they could but lost out in the end due to lack of labor, increased labor costs, raw material increases, or inability to remain competitive without replacing aging (or investing) in new equipment.

Taking all the above into consideration, the cost of building new foundries and government regulations imposed on the industry – new facilities are not considered a good investment. Within the past few years, customers looking to return to the US for their castings, developing new product lines, or trying to relocate their parts, are finding it difficult to find a foundry that fits their needs, is competitive, and has capacity.

NEW MANAGEMENT

New management always presents new ideas regarding how production should be completed, or even a complete overhaul of the business model. In any case, this is always a very hard time of adjustment for both the foundry and the customer.

It's not all doom and gloom as there are many foundries making investments in new equipment to increase capacity. This is a huge undertaking that can take up to a year to see real results. The market is booming right now which can change tomorrow, so making the decision to invest takes some serious thought and time.

Buyers will remain loyal to a foundry who has provided them with quality parts. They will weather the storm until it passes or for as long as possible and that is a true partnership. For those who cannot, moving a part to another foundry is a monumental task. Whether it be a new product or existing, below are some tips to help make the transition a little smoother.

1. If you have a beautifully designed new part that you poured your heart and soul into developing, please do not be offended if a foundry requires changes in order to produce it. The foundry experts are not trying to impugn your work, but instead provide you with information to reduce thecost of the product, or simply that the design is not conducive to casting.

2. If you are re-locating an existing part and want to move the tooling, pleaseprovide the tooling description in your RFQ. Sometimes a buyer will not want to alert their supplier that they are shopping but it is nearly impossible to guess what the equipment is and therefore, the quote may be contingent on whether they guessed correctly. The tooling may also be in poor condition and need to be replaced. After reviewing the current equipment, the new foundry may have a more efficient way to produce your part resulting in a significant reduction of your piece price.

3. Please remember that when relocating older equipment, you will receive a product of the tool. Many times, small "tweaks" made to the parts over the years have not been updated in the drawing. If samples are submitted from current tooling and compared to the drawing for approval, there is a high probability of discrepancies.

4. Keep in mind that not all metalcasters are the same. Your part may not be the best fit for one but ideal for another. If you're shopping new foundries, get a few quotes to determine the market value of your part. It does help to discuss the issues that lead you to relocating your work with prospective foundries. Do they face the same issues as your current supplier? What do they do differently? Is this part well within their capabilities?

5. Determine what pricing really means to you. Can you sacrifice lead time, quality and service to save $.10?

There's a lot of work in finding the perfect fit and with the ever-increasing workload buyers endure, it has become nearly impossible to be as diligent as I'm sure most would like to be. This is where I fit in these days. I will not pretend to know everything about every foundry, but I do work with some of the best and can help my customers determine what molding process is optimal for their needs, and who will be the most competitive.

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PART BUYERS AUTHORITY

Are you a manufacturer of metal, plastic, or composite parts?

If so, we encourage you to contribute as an author in our next issue of ***The Part Buyers Authority***, an industry online publication. Featured authors are positioned as the topic expert in your 2-page article. Your company will also receive a full page advertisement (for a total of 3 pages). As an additional benefit, competitors to you cannot contribute in the same publication to provide you with dedicated space to your expertise.

Our sole focus of ***The Part Buyers Authority*** is to provide technical information to assist anyone that designs, specifies or purchases metal, plastic or composite parts. Specifically we will address the changing technologies that affect the many ways that parts can be manufactured.

The Part Buyers Authority will be issued several times a year on topics of interest to buyers of parts.

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To contribute, please contact Barb Castilano by calling 937-436-2648 or email barb@moptions.com

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RESOURCES

Below is a resource listing that would be of benefit for those involved in purchasing, specifying, and designing parts. Have a resource you would like to see added to this list, or a topic, material, or process discussed? **Complete our form at partbuyersauthority.com**

Metal Part Manufacturers

Alliant Castings	www.alliantcasting.com
Banner Metals Group, Inc.	www.bannermetalsgroup.com
Dysinger Incorporated	www.dysinger.com
Epcor Foundry	www.epcorfdy.com
Hazelton Castings Comapny	www.wecast.com
Innovative Casting Technologies	www.innovative-castings.com
	www.innovative3dm.com
Kentucky Chrome Works	www.kentuckychromeworks.com
ODIN Casting	www.odincasting.com
R&M Sales	www.r-msales.com
Southern Cast Products	www.southerncast.com
Tech Cast	www.techcastllc.com
Trident Alloys	www.tridentalloysinc.com
Yankee Casting Co.	www.yankeecasting.com

Suppliers of Technology for Part Buyers

Foundry Solutions	www.solutionsfonderie.com

Contract Packaging

Crown Packaging	www.crownpkg.com

Additive Mfg Consulting/Part Design Consulting/Engineering

Carl Berube, Celero Partners	www.celero-partners.com
Chris Wentworth, CMTC	www.CMTC.com
Will Shambley, New England Foundry Technologies	www.nefoundrytech.com
John Kuhn, Rimrock Corporation	www.rimrockcorp.com

Industry Associations

3D Printing Industry News	www.3dprintingindustry.com
Additive Manufacturing	www.additivemanufacturing.media
Additive Manufacturing Users Group (AMUG)	www.am-ug.com
America Makes	www.americamakes.us
American Foundry Society	www.afsinc.org
ASM International	www.asminternational.org
Ductile Iron Society	www.ductile.org
Investment Casting Institute	www.investmentcasting.org
National Tooling & Machining Association	www.ntma.org
North American Die Casting Association	www.diecasting.org
Precision Machined Products Association	www.pma.org
Precision Metal Forming Association	www.ntma.org
SME	www.sme.org
Steel Founders' Society of America	www.sfsa.org

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