American Foundry Society
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Subject: M-TAC RFI Comments

American Foundry Society (AFS) response to requested information on M-TAC

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Why M-TAC and why now?

The U.S. manufacturing base has experienced significant pressure during the last 15 years, as many of their customers have pursued a Low Cost Country (LCC) strategy to develop a supplier base abroad and reduce costs. The result of this activity was pressure on the domestic supply chain, reduced operating margins for those attempting to match price and often closure of operations and companies. But the landscape is changing. As the remaining manufacturing base implemented new technologies, became more efficient and pursued value added total solution approaches coupled with increased cost to ship product from overseas, logistic and quality issues it became apparent that the off-shoring strategy was not working. This has led to a surge of manufacturing in the U.S. and acceleration in efforts to reshore products and services back home.

But with the opportunities are still challenges, especially for the SME. How do they get access to resources and technologies that make them more competitive? Also, how do they identify opportunities to expand their market and perhaps even export? The growth and support of the MEP network has led to a renaissance in manufacturing in many regions, especially those served by a strong MEP. Many of the classic process improvement techniques (lean manufacturing and six-sigma), improved business practices and supply chain management have been made available to the SME via the MEP. These factors all create an environment where the next step for improved competitiveness and sustainability via incubators that can accelerate technology transition can thrive and flourish.

So why a Cast-TAC – casting focused manufacturing technology acceleration center.

National Need

Metalcasting has traditionally been the most flexible, efficient and economical manufacturing approach for complex, high performance and tight tolerance components with more than 90% of all manufactured goods relying on metal castings. The metal casting manufacturing sector is a vital supplier of critical components used in defense, energy, automotive, aerospace,

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transportation, mining, infrastructure, agriculture and medical applications while offering employment to more than 200,000 individuals across the United States. Examples of engineered metal castings include automobile and truck engine cylinder blocks, hip and knee implants for the human body, turbine blades for jet engines and golf club heads for irons.

Today's U.S. metalcasting industry faces challenges from increased foreign competition, escalating raw material, energy and health care costs, greater regulatory burden and a general decline in the scope and size of U.S. manufacturing. The result has been a reduction in the number of metalcasting facilities in the U.S. from more than 3,000 in the late 1990s to 2,001 facilities today. The loss of metalcasting experience and knowledge means that if demand in a specific market sector dramatically increases such as with a world-wide military conflict, this vital manufacturing sector would need significant investment to meet the suddenly greater capacity needs.

The effect of the loss of metalcasting capacity has been demonstrated in current supply chain constraints in the U.S. automotive industry as it ramps back up from 10 million annual vehicle builds in 2008-2009 to 15-16 million today (more than 30% of castings produced in the U.S. go to the auto and truck market). At the low auto production levels, certain key cast component suppliers either closed or permanently exited that sector to shift to other markets like agricultural or mining. With every automobile containing more than 300 lb of engineered castings for the engine, suspension and braking systems, the auto industry is having to recalibrate its metal casting supply chain and, in some cases, delay its auto assembly ramp-ups to meet the new supply scenario.

Similar supply conditions could be on the verge for the still developing renewable energy market and for the U.S. Defense Department. The demand for renewable energy is one of the top priorities for the U.S. now and in the decades to come. Wind, solar, geothermal and even fusion technologies are all metal casting dependant in their generation systems (the average commercial wind turbine contains more than two tons of metal castings) and in the systems used to deliver the energy. For the U.S. military, every tank, plane, jeep and fighting system requires castings, and a supply base that is nimble enough to produce these components in small quantities with quick turnarounds. Currently, the U.S. military utilizes 10% of the castings produced by U.S. manufacturers.

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Recapitalization of the metalcasting industry is necessary for U.S. metalcasters to participate and prosper in these and other future growth markets. A barrier to their recapitalization is the low profit margins at which the industry has realized even in good economic cycles. The 2007 American Foundry Society and North American Die Casting Association's Operational Cost Study reported that metalcasting profits averaged only 5.7%. If the U.S. metalcasting industry is aided in recapitalization, metalcasters could implement cost-efficient technologies that are competitive in the global market and directed at expanding market segments by offering highly engineered, value-added products with the latest material innovations at competitive pricing. This would make metalcasters true partners with the developing markets that need them most, like renewable energy, automotive and military.

Regional Need Example

In the U.S., metal castings are produced by 2,001 different operations, 80% of which employ less than 100 people. The state of Michigan has 120 metalcasting facilities and 20 supporting supplier companies employing more than 15,000. The state of Wisconsin has 126 metalcasting facilities and 25 supplier companies employing more than 19,000 at an annual payroll of $478 million with $2.1 billion in sales.These states contain key suppliers to the automotive, agriculture and defense markets, including transmissions for Allison Transmissions, piston accumulators for the Los Angeles class submarine, forward and rear fuselages for the ATCM Brilliant Anti-armor Technology Missile, Expeditionary Fighting Vehicle steering deflectors, and the Guided Multiple Launch Rocket System payload body. These states also produce engineered cast components for the U.S. Department of Energy and commercial energy applications including conventional, renewable and alternative energy technologies.

In 1955, the U. S. metalcasting industry had 6,150 plants. Since then, technological and regulatory factors, as well as the off-shoring of manufacturing, have resulted in tremendous changes and the reduction to 2,001 plants. Despite these challenges and the reduced profit margins, metalcasters are finding ways to succeed. Today's metalcasters produce an average of 6,000 tons of castings per plant compared to 4,900 tons in 1999.

An example of this resurgence can be seen in the second-largest metalcasting firm in the U.S. today—Grede. In the early 2000s, Grede was a family-owned, multi-plant firm based in Milwaukee, Wisconsin. But foreign competition and dramatic increases in the cost of raw

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materials in the U.S., forced the firm into bankruptcy. At the same time, Citation Corp., Novi, Mich., was experiencing profitability problems trying to serve the automotive industry.

During the recent recession, these firms took the opportunity to combine their capabilities to form a "new" Grede that is more streamlined to meet the needs of a more diverse customer base. Individually, the firms weren't able to react quickly enough to market trends, technology innovations and customer demands. The new Grede has been able to redevelop itself as a nimble supplier. The result is a firm whose sales are growing along with its capabilities. The new Grede now has 16 metalcasting facilities and four machining plants producing more than 600,000 tons of casting production annually.

Another success story in the state of Wisconsin is Eck Industries in Manitowoc. This family-owned metalcaster employing more than 200 is a force in adapting new technologies and assisting with developing new materials such as metal matrix composities and nano-related metalcasting. Eck also is leading the commercial development (along with Oshkosh Truck and the American Foundry Society) on the University of Wisconsin-Madison U.S. Department of Commerce NIST's Technology Innovations Program, "Transformational Casting Technology for Fabrication of Ultra-High Performance Lightweight Aluminum and Magnesium Nanocomposites."

Metalcasting SWOT

With 80% of metalcasters employing less than 100 people, the industry is diverse. Following is a SWOT (strengths, weaknesses, opportunities and threats) Analysis of the U.S. metalcasting industry to try to encapsulate where the industry currently stands.

Strengths

- Technology Development—Despite the limitations in capital, U.S. metalcasters, their supply base and universities are leading the globe (along with Europe and Japan) in pushing out new technologies to increase global competitiveness. Examples of the new technologies include rapid manufacturing techniques eliminating hard tooling, automated pouring of molten metal, and enhanced simulation of the casting production process to test designs virtually.

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• Raw Material Availability—From sand to scrap metal to cost-competitive energy, the U.S. has the greatest abundance of critical raw materials required for metalcasting.

• Proximity to customers—U.S. OEMs are still some of the largest consumers of metal castings in the globe and much of their purchasing decisions and product assembly is still done in the U.S. This allows U.S. metalcasters to interact with component designers, buyers and the manufacturing and assembly plants directly.

• Increasing productivity—As referenced previously, U.S. metalcasters are producing greater numbers of castings per facility every year through more advanced technology and the application of lean principles.

Weaknesses

• Technology Adoption—Low profit margins have not allowed metalcasters (most of which are small businesses) to reinvest in their facilities at the rate necessary to maintain growth The technology is being developed, but the expense both in captive and human resources is too difficult for many metalcasters to implement into their operations.

• Industry Perception—Since consumers don't purchase metal castings on their own (they are part of another product), the U.S. industry isn't recognized for how critical it is to society. It is also thought to be low-tech and thus

• Next Generation Leaders—Like all manufacturing, metalcasting is working to develop young talent for the next generation. The industry has a unique partnership to drive this for the future called the Foundry Educational Foundation that partners students with universities and industry to help talent enter metalcasting.

Opportuntiies

• Conversion to Castings—The benefit of metalcasting compared to other metalforming processes is that the process of metalcasting (pouring molten metal into a mold) allows almost limitless geometric freedom in component design. As a result, many weldments, fabrications, forgings and stampings can be redesigned to metal castings at reduced costs and enhanced functionality. It just requires educating customers on how to do it.

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• Value-Added Processes: machining/design- Those companies that are more than just make-to-print but assist with component design can improve the service their offer their customer. Also, more casting buyers want their suppliers to perform more value-added processes such as machining, painting and heat treating to their components. More and more metalcasters are offering these services to customers to come more valuable members of the supply chain.

• Rapid Manufacturing—Time to market is critical for OEMs. Metalcasters are working to integrate the latest rapid manufacturing technologies into metalcasting to produce tool-less castings in days rather than weeks or months.

Threats

• Alternative Materials—Plastics and powdered metals continue to market against metal castings, but the key is the geometric freedom offered by metalcastng in conjunction with the material properties offered by engineered cast metal.

• Government and Regulatory Burden—With 80% of metalcasters employing less than 100 people, regulatory burden is a significant strain on U.S. metalcasters. These plants cant afford to dedicate multiple individuals to address the increasing levels of regulation, but they are often forced to. This impacts a plants bottom line significantly.

Challenges

With more than 80% of U.S. metalcasters as small businesses (SMEs), they often lack the capital to secure and/or develop the latest technologies and/or processes to competitively address U.S. market needs. While this is one of the greatest challenges facing this industry, following is a summary of others:

• Low profit margins make reinvestment difficult (only 5% of metalcasters are spending on new technology and/or capacity)

• Reduction in U.S.-based OEMs and their suppliers strains the supply chain, reduces new product innovation and lessens the availability of technical information on new technology and resources

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- Expertise and knowledge is retiring without a strong mentoring program to train the next generation
- Highly fragmented industry with many metals, processes and customer markets
- Minimal excess capacity in the supply chain (industry was operating at more than 90% of capacity as recent as 2012)
- Less than 10% of metalcasters are fully integrated manufacturing facilities providing finished parts (heat treated, machined and painted) from one plant
- Designers require greater education on metalcasting because they look first to competing processes and materials when cast materials would provide greater benefit's like wear resistance, strength, heat resistance, corrosions resistance and weight savings
- While the level of casting imports to the U.S. has dropped the last two years, it still represents 23% of casting demand from U.S. buyers

The core technologies represented by metalcasting, despite being fundamental, are critical to U.S. economic health and industrial capability. Metalcasting processes pervade all industry sectors. Globally, forgings and castings production was estimated in excess of $56 billion in 2011, according to Lucintel, and is expected to grow to over $78 billion by 2017. If the small and medium-sized metalforming companies in the U.S. have access to, and use, new technologies, tools, and processes, they will be preferred from suppliers overseas that do not have access to use the tools.

Approach

The core technologies represented by metalcasting, despite being fundamental, are critical to U.S. economic health and industrial capability. Metalcasting processes pervade all industry sectors. Globally, forgings and castings production was estimated in excess of $56 billion in 2011, according to Lucintel, and is expected to grow to over $78 billion by 2017. The importance and need for metalcasting is in the market place and opportunities exist to implement new materials and technologies that can make this a growth sector. If the small and medium-sized metalforming companies in the U.S. have access to, and use, new technologies, tools, and

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processes, they will be preferred from suppliers overseas that do not have access to use the tools. But how do we change this landscape, especially for the SME?

The proposed Cast-TAC program will focus on identifying, informing and implementing opportunities to create a sustainable manufacturing environment that will allow for more efficient & profitable manufacturing casting methods to produce various vital defense and commercial components in the shortest possible time. Much of this technology is being developed in the U.S. by suppliers, universities and the manufacturers, while some is from overseas. The AFS offers many forum and platforms to make the metalcasting industry aware of what are the latest developments, where it is and what it can do for them. The important focus of a Cast-TAC is focus on matching that technology with the appropriate situations and insuring that the new technology will be implemented quickly and effectively through a partnership with the MEP structure.

This program will help the Wisconsin and U.S. metalcasting industry improve their manufacturing readiness through a variety of production technologies, advancements in the metal alloys to enhance properties and performance, and an extension in the state of the science in net shape manufacturing and rapid prototype/production technology. This will create the greatest opportunity and benefit to U.S. metalcasters to implement these technologies to manufacture the best available cast components for our nation and reverse the trend of market erosion. Program involvement by a cross-section of manufacturing, academia and research sectors coordinated through the Manufacturing Enterprise Partnerships and the proposed Accelerator Center will ensure rapid technology transfer and the creation of highly skilled manufacturing jobs.

For an industry that is fragmented due to the size of its firms and diversity of its demands, the Center will coordinate resources and funding and help ensure a continued source of American casting producers to supply the cast component needs for national defense, infrastructure, automotive, transportation, agriculture, mining, construction, energy, medical and other segments. The Cast-TAC will advance the technology and manufacturing processes such that the U.S. can remain competitive with offshore suppliers fighting for access to our commercial customer base. Successful implementation of this program can add new and more energy

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efficient production technologies and manufacturing lines and help us grow/and preserve these vital capabilities.

The establishment of a Cast-Technology Acceleration Center will enhance the speed and efficiency of cost-effective production practices for U.S. metalforming companies and increase their ability to compete on a global scale. The areas of focus for this TAC would include:

- Identification and adaption of technologies that would advance manufacturing and sustainable practices
- Integrated modeling tools to simulate and design cost-effective processes and high performance materials for demanding applications
- Tools to ensure rapid, cost-effective, quality parts meet delivery requirements
- Improved manufacturing processes and standards to support the U.S. supply chain and ensure competitive, best value sourcing
- Enhanced access to improved technical data for rapid, precise production methods
- Investment in workforce development and training along with an approach to ensure a supply of new, highly skilled employees
- Collaborative partnerships including large, medium, and small businesses as well as the supplier and user

1. What are the specific types of technology transition and commercialization tools and services that should be provided by M-TACs? Emphasis is on the alignment of these tools and services with the most pressing needs of small and mid-sized U.S. manufacturers.

Response: As a manufacturing technology acceleration center with a focus on the SME, the M-TACs first identify what key technology transition and commercialization tools and services are needed for that market sector. As it relates to Cast-TAC, these could be process related, material related or skill set related. The latest advances might not be locally developed or even in the same or associated manufacturing sector. The first step is identification of the technologies that can improve current practices and expand capabilities and markets, while also potentially creating game-changing opportunities. This is followed by informing the stakeholders in a format that is easy to understand and relevant to their operations. The commercialization tools must be facilitators that take down barriers to implementation and integration. This might include the ability to secure hands-on experience to evaluate a technology without the upfront

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investment cost and to identify funding sources and subject matter experts that can assist with the smooth transition to the manufacturing floor as well as serve as a resource if problems arise. The kinds of tools & services Cast-TAC would provide for this effort include:

- Benchmarking and data gathering trips to identify the most appropriate technologies
- Site visits to member companies, evaluations and technology/business plans
- Matching the Best Available Technology to the member's needs
- Workshops, seminars and workforce training
- Technology implementation plans
- User groups - discussion of Best Practices and experiences with peers

a. How would M-TAC services complement the services currently offered by MEP Centers?

Response: The MEP's, like WMEP, have the structure, network and experience of interfacing with mid-sized U.S. manufacturers to work on similar issues, like lean manufacturing. This is an extension of that effort to a specific market sector. The SME's are comfortable collaborating with MEPs, using their services as a key resources. The M-TAC will be an enhancement of that offering to the focus sector. The MEP's provide the skills necessary to fully leverage technology.

2. *What role should future M-TACs play with respect to supply chain needs? How should OEMs participate? How can industry associations, professional societies, and other appropriate national organizations participate?*

Response: The M-TAC should be a vital resource to enhance the capabilities of the supply chain. Manufacturers need a customer for their product or service and customers (OEMs, etc.) need to have a strong and reliable supply chain to maintain their competitiveness. Therefore, the OEM's create the want and need and ultimately the expectations. They should also be the source revenue as they purchase the product and service from their supply chain. Industry associations, professional societies, and other appropriate national organizations participate as an independent and unbiased partner in the process, assisting in identifying the key technologies and promoting the adoption and implementation. They can also bring into the MEP network those groups that may not be familiar with it, thus becoming a conduit between the specific manufacturing sector and accelerator (M-TAC) and other resources. This will also expand the opportunities for the MEPs.

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3. *Is there a particular long-term scalable and financially sustainable business model that should be implemented by future M-TACs that will enable small and mid-sized U.S. manufacturers to effectively access and benefit from the technology transition and commercialization assistance and other resources they need?*

Response: In Europe, the Fraunhofer Institute is a good example of a long-term scalable and financially sustainable business model that has enabled small and mid-sized manufacturers to effectively access and benefit from the technology transition and commercialization assistance. In the U.S., a metalcasting-related example is the ACRC (Advanced Casting Research Center)—a consortium based effort at Worchester Polytechnic Institute that has been run for more than 20 years with a strong effort for technology research, transition and information transfer. With each of these efforts, the important aspect is establishing consortium that requires some level of investment for participation but also value that far exceeds the cost for participation via leveraging your monetary and human resource.

a. *Because of the programmatic connection to the NIST MEP Program, M-TACs may require cost share. Are there cost share models for future M-TACs that promote scale up to reach nationally dispersed clusters of small and mid-sized manufacturers? If so, what are those models, and why might they be successful?*

Response: The ACRC mentioned above is such an example. Also, the American Foundry Society (AFS) requires that all projects they fund via an allocation of corporate member dues are matched by at least 30% cost share (monetary or in-kind) for the project to be considered for funding. AFS also has recently conducted several successful projects that were 50/50 co-funded with a consortium of interested companies. It is important to have skin in the game and also a very strong steering committee and oversight group.

b. *The generation of intellectual property is possible, and even likely as a result of M-TAC operations. What types of intellectual property arrangements and management constructs would promote active engagement of industry in these pilots, especially among small and mid-sized U.S. manufacturers that would be supportive of the business model? As appropriate, please include a set of potential options, and please explain your responses*.

Response: The mechanism to handle IP is extremely important and needs to be included in the structure of the M-TAC. If companies utilize M-TAC facilities and resources on a pay-to-play

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basis, i.e. contract work, then they should retain any IP derived from that work. For work that is funded out of M-TAC general funds, which may include funding derived from membership by sponsoring companies to the M-TAC, then the IP rights are retained by the M-TAC and the members might be given a royalty free use. For unique work that might have prior art and conducted outside of M-TAC facility, like at a university, then arrangements could be made to assign the IP to that organization with some type or royalty free or reduced licensing agreement to M-TAC and its members, but with rights to use the technology developed.

4. How should an M-TAC's performance and impact be evaluated? What are appropriate measures of success for future M-TACs? Please explain your response including the value of the performance measure to business growth.

Response: One measure of success is increased sales dollars, market share and/or market growth by companies utilizing a technology or service provided by the M-TAC. This comparison also could be achieved by comparing the EBIT or EBITA of the new work vs. traditional work or value-added sales revenue (removing the cost of materials like metal) generated per employee. The key is to focus on identifying and accelerating technologies should be on those that return a higher value, thus allowing for more investment in the business as compared to low margin work. Another measure is to compare the Value Added Sales revenue (removing the cost of materials like metal) generated per employee as compared to current product. The overriding metric is foundry profitability. Also, the increase in sales from product previously sourced off-shore (reshored casting) will demonstrate that this effort is having a positive impact turning the tide back to Manufactured in America.

5. Are there any other critical issues that NIST MEP should consider in its strategic planning for future M-TAC investments that are not covered by the first four questions? If so, please address those issues here and explain your response.

Response: Future M-TAC investments must consider support for new manufacturing and support company start-ups. This new manufacturing will increase the supply chain and opportunities for the MEPs in the regions interfacing with the M-TAC. In addition, this new commercial work will require education, training and other work-place opportunities that will require collaboration with local universities, technical and community colleges and high schools.