SCRA Applied Research & Development offers the following to establishing a *Netshape Metalforming Institute (NMI)* to serve as a national hub for netshape metalforming manufacturing excellence. This center would be designed to provide competitive advantages and opportunities for United States (U.S.) manufacturers to meet the needs of both the commercial and defense sectors. The following comments are offered in response to the U.S. Department of Commerce, National Institute of Standards and Technology Request for Information on Proposed New Program: National Network for Manufacturing Innovation (NNMI).

Netshape Metalforming Institute (NMI)

Summary

Manufacturing processes by which parts or components are fabricated from metal stock is defined as metalforming. Netshape metalforming includes processes which yield product forms very close to the final geometric dimensions of the finished component. Netshape metalforming involves a variety of processes including these processes critical for myriad applications:

- Mechanical working, such as forging, extrusion, rolling, drawing, hydroforming, and various sheet-forming processes
- Casting – sand, die, investment, permanent mold
- Powder and fiber metal fabrication
- Metal injection molding
- Hydroforming

Challenges

Most of the U.S. manufacturers involved in metalforming are small businesses and lack many of the newer technologies and/or processes to competitively address global and U.S. metalforming needs. These challenges include the:

- Demise of many original equipment manufacturers/suppliers
- Availability/ obsolescence of technical data and/or specifications
- Retired expertise
- Lost or discarded tooling
- Offshoring of metalforming capability

These core technologies, despite being fundamental, are critical to economic health and industrial capability. Metalforming processes pervade all industry sectors – especially automotive, aerospace, energy, and defense. 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 suppliers to overseas companies that do not have access to these tools. Establishment of a Netshape Metalforming Institute 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. Areas of focus would include:

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- 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
- Collaborative partnerships including large, medium, and small businesses
- Investment in workforce development

The Netshape Metalforming Institute's proposed strategic direction is to ensure a robust, reliable, and globally competitive U.S. supply chain for high quality metallic parts. The program will utilize distributed technology management among industry, academia, and other research resources to develop, leverage, deliver, and apply innovative technologies and processes to support the U.S. metalforming industry. The institute will enlist the nation's top academic metalforming researchers, industry experts, and the metalforming industry associations and their members to ensure relevant research and the rapid transition of results into U.S. industry. The overall goal is to enhance the competiveness of U.S. metalforming industries through improved quality, cost efficiencies, and reduced lead times. Results associated with technology development will be made available to industry technical societies and the U.S. government for dissemination to the U.S. manufacturing base. The program will ensure a dependable U.S. metalforming manufacturing base for the future.

- ***Cost-effectiveness*** will develop metalforming applications to reduce cost while improving quality and performance.
- ***Rapid acquisition*** will provide the solutions to improve manufacturing speed and predictability, tools for capturing process data, and processes for applying solutions to short lead time procurements.
- ***Quality*** will develop tools for improving technical data, tools for best value source selection, processes to qualify new materials and manufacturing processes, tools to identify applications, and improved standards.

Key focus areas would include:

- New metalforming technology and processes
- Guide for and demonstration of methods for reverse engineering / additive manufacturing
- Tools for production lead time reduction
- Simulation software to predict strength and fatigue life of net shape products
- Improved billet inspection technologies to increase the size of feedstock for forging operations
- Digital radiographic inspection standards
- Web-based tools for work force development
    - process and design specifications/standards
    - tutorials
- CAD package interfaces to improve design
- Access to enhanced technical data packages
- New alloy development based on desired properties via Integrated Computational Materials Engineering

- Solutions for reliability re-engineering
- Process improvements for both high-volume and short-run quantities
- Workshops and webinars / seminars
- Demonstrations and in-plant trials
- National technology reviews to present, demonstrate, and transfer new research results
- Publications for emerging technology and events in industry trade journals
- Web sites for disseminating results, presentation materials, meeting dates, and other information

Netshape Metalforming Institute (NMI)

A powerful model for a *Netshape Metalforming Institute (NMI)* will utilize distributed center management to best leverage existing commercial enterprises, academia, development centers and federal and state initiatives to develop fully tested products and sustainable solutions for the production of netshape metal formed components. A NMI will enlist the nation's top academic metallurgical researchers, industry experts, and the netshape metalforming industry associations and their members to ensure relevant research and the rapid transition of results into U.S. industry. The overall goal is to enhance the competiveness of the U.S. metalforming industries through improved quality, cost efficiencies, successful transition to commercialization and reduced lead times. The U.S. metalforming industry will work in a cooperative environment to fairly distribute development opportunities and facilitates industry collaboration.

Benefits to the distributed center management model include low overhead cost, deferred amortization, and maximized development funding for the industrial base. SCRA Applied R&D has successfully demonstrated this model in the management of the Forging Industry Association – Department of Defense Manufacturing Consortium (FDMC) and the American Metalcasting Consortium (AMC). Both the AMC and the FDMC form integrated development teams from a consortium of companies that include foundry and forging industry suppliers, small businesses and academic institutions to address metalforming manufacturing challenges affecting components on legacy weapon platforms. SCRA Applied R&D's management of the Cast Metals Coalition (CMC) uses this model to address energy-saving opportunities in the metalcasting industry for the Department of Energy (DOE). Improved process and equipment technologies implemented under FDMC, AMC, and CMC have resulted in successful transfer of technology for substantial savings on a variety of metalforming processes. Under the FDMC and AMC programs, teams have successfully implemented supply chain improvements resulting in $3M of yearly savings and 23% reductions in administrative and production lead times for cast and forged parts. To date, CMC innovations have resulted in an average annual energy savings of 16.5 trillion BTU's/year. This established model for measuring performance improvements will be deployed across the NMI network.

Structure

A successful institute will integrate public and private partnerships and combine commercial and academic research and development. It will extend the successes demonstrated by FDMC, AMC, CMC, and other net shape forming partnerships, utilizing a similar distributed center model, focusing on commercial applications, and widening the mission to include workforce development. By leveraging existing infrastructure and development centers overhead cost are minimized, providing the maximum funding for industry and academic driven projects. Adoption of new technology would be accelerated via joint projects between start-ups, established manufacturing companies and universities. The aim is to support research institutions and business enterprises – especially small and medium-sized enterprises- in research, development and commercialization activities.

This model will provide easy access to small businesses and academic institutions, as well as incentivize larger businesses to take advantage of the innovative resources offered to accomplish work

Technology Stewardship

A Technical Advisory Group, established to review all research proposals, select projects for funding and provide technical guidance, will include members from the government sponsors and metalforming industry sectors (i.e. automotive, aerospace and marine) as well as members who represent material suppliers, machining and small businesses. Diversification of the technical advisory group will ensure funding is fairly distributed to achieve maximum impact on the industrial base.

Manufacturing Innovation

The core focus of a NMI is transitional research that bridges the gap between academic activity and industrial need. NMI will focus on developing manufacturing methods, test and inspection standards, validation data and training required to reduce the risk of transitioning research from laboratory to receptor industries. Projects will address the pitfalls of new technology/products by generating validation test data, prototype funding, and qualification requirements. Funded projects are obligated to use research findings in the commercialization of marketable, innovative products, processes and services to strengthen the U.S. metal manufacturing industrial base.

Two main categories of projects are suggested; 1) projects which have broad applicability to the industrial base, and 2) projects focused on specific manufacturing or product development. This dual approach will widen participation in projects, increase research that will have broad applicability to the industrial base, and result in demonstration projects, successful technology transition and new product introductions.

Intellectual Property

A NMI will manage collaboration as an honest broker, with the needs of the industrial base in mind. It is expected that projects will involve the pre-existing intellectual property of multiple partners. In order to encourage partners to bring these concepts into the NMI for further refinement and development, strict protections for privately owned IP will be put into place.

The two thrusts of research projects will create Intellectual Property (IP) that will be either broadly applicable to the industrial base or specifically applied to a developed application. IP which is narrowly applicable to company funded developed products will vest with that company. IP which is broader in application will be jointly owned by the participating partners and the NMI, and will be available to the US industrial base.

Networking, Education and Workforce Development

Education and training of qualified personnel is one of the most important steps to develop and produce successful products; a NMI network will partner with the existing nationwide Manufacturing Extension Partnerships (MEP) to leverage established MEP programs that reach into workforce development and technology transition. Additionally, a NMI network will establish partnerships with other existing federal, state and local government initiatives working in Science, Technology, Engineering, and Mathematics (STEM) Education. These partnerships would include: Project Lead the Way (PLTW); National Science Foundation initiatives, NASA Education Student Programs among others such as ASM International's Materials Camps

Projects proposed to the NMI will be required to address workforce development opportunities for partner organizations. These training opportunities will benefit the collaboration in the near term and the industry in the long run, maturing the skilled personnel to fill the jobs created by a growing market.

Sustainability

Initially, a NMI would use government funding as seed money for new projects. Cost share would come from industrial partners in the form of access to capabilities and equipment. Funds input into the NMI would come from participant contributions and licenses from generated IP. The goal will be to transition NMI to a separate self-sustaining non-profit organization once revenue generation will support the transition.

Support of other NMMI Centers

A NMI will leverage the capabilities of the NNMI network to identify cross cutting technologies for joint development projects. Metal formed components are almost exclusively the framework or basis for larger systems which may include materials such as composites and advanced polymers. Identifying manufacturing methods for joining, automation, inspection and testing systems will require the collaboration of NNMI centers. NMI will network with other NNMI centers to identify best practices and win themes for continuous improvement and growth of the industrial base.

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