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American Competitiveness Worldwide: Impacts on Small Businesses and Entrepreneurs

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Chairman Rice, Ranking Member Chu, and other distinguished Members on the Subcommittee, thank you for having me here today. It is an honor to share with you on a public-private partnership with which the Council on Competitiveness has been heavily involved since its inception, the National Digital Engineering and Manufacturing Consortium. This program currently wrapping up its pilot phase is a pilot public-private partnership connecting small and medium-sized manufacturers with high performance computing via modeling and simulation.

U.S. manufacturers are being challenged today by an unprecedented confluence of global events. This convergence of powerful internal and external forces—The Great Recession, global economic contraction, the U.S. automotive manufacturing base receiving from the financial crisis and the recession, and increasing competition from overseas—is challenging U.S. manufacturing leadership like never before. Indeed, these extraordinary circumstances require

extraordinary measures, and the U.S. public and private sectors must cooperate strategically, coordinating and investing to repair, reposition, and reaffirm U.S. global leadership in manufacturing.

Research by the Council on Competitiveness presents powerful evidence of the capacity of high performance computing (HPC) to drive innovation and make U.S. companies and the nation more competitive. Indeed, for those who have adopted it, HPC represents a crucial edge that can build and sustain competitive advantage through innovative product design, production techniques, cost savings, improved time-to-market cycles, and overall quality. However, Council research has also shown that many U.S. companies are "stuck at the desktop" and not able to take full advantage of HPC, while still others—including many suppliers to U.S. tier 1 companies—have limited, if any, computational R&D capacity (with many not even using desktop workstations).

Our situation becomes even more critical when one surveys the competitive landscape that U.S. companies face today—where many foreign governments have established public-private partnerships for the use of HPC in manufacturing. Indeed, sustained national investments in innovation and manufacturing are occurring in China (e.g., China's 863 Program), the European Union (PRACE program), and in the UK to name only a few. Meanwhile, our own national policy regarding HPC is fragmented. The time is right for the U.S. federal government to take bold steps to leverage HPC for next-generation innovation, manufacturing, and U.S. competitiveness.

The Council sees public-private sector collaboration as the best and most effective means for quickly advancing HPC in manufacturing. However, to be successful in this effort, much closer coordination between government, national labs, universities, and industry will be needed and must be bolstered by a national strategy that transcends the parochial interests of any single federal agency, department, university, or HPC center. To these ends, the Council offered several recommendations for quick action:

- Improve coordination of the federal government's overall approach to advancing HPC (i.e., work toward a more balanced program across DOE labs, NSF-funded supercomputing centers, the DOD, universities, and so on).
- Increase outreach efforts to chief executives (the so-called "C-suite") in manufacturing to help them better understand the true benefits of HPC to their bottom lines. Bring together CEOs and CTOs from the nation's manufacturing base, along with U.S. experts in HPC hardware and software, in a national summit to better frame and address the issues surrounding HPC for next-generation manufacturing.
- Enhance industrial access to HPC resources by establishing a government-supported HPC center or program dedicated solely to assisting U.S. industrial partners in addressing their research and innovation needs by adopting or improving modeling, simulation, and advanced computation.
    - The center or program would provide assistance with problem definition; software selection, development, or customization (indeed, software is often the most crucial gap); and access to HPC hardware.
    - It should feature a task force or working group that would (1) visit all top U.S. manufacturing companies, HPC centers, national labs, and major independent

software vendors (ISVs); and (2) work to address major technical hurdles in the manufacturing sector's use of HPC (e.g., software, interoperability, multiphysics, and so on).

    - It should be overseen by an advisory board with balanced membership from government, university, and industry.
    - It could be started with initial funding from the federal government, but should be supported in the long term by a broad mixture of support from federal, university, and industrial partners.

- Invest in U.S. HPC expertise. Some of our most precious national resources are the people who operate in the HPC domain—from the computational scientists and engineers to the domain experts that apply HPC in their fields (e.g. mechanical, electrical, chemical engineers). The federal government, national labs, universities, and industry need to take concrete steps to educate, train, retrain and retain people with the expertise to take advantage of large HPC systems and manage their application and deployment in new settings, and create the new software and hardware needed to drive innovation.

The Council on Competitiveness and selected original equipment manufacturers (OEMs) developed a Midwestern regional pilot program as a public-private partnership with the U.S. federal government based on these recommendations. The pilot program is aimed at improving competiveness and innovation in small- and medium-size enterprises (SMEs) in the U.S. manufacturing supply chain. The ultimate outcome of the pilot program will be a workforce with enhanced technical skills, improved product quality, better customization of products, and job retention and growth.

On August 31, 2010, a Summit & Workshop was held at the Gleacher Center in Chicago that brought together representatives from a broad cross-section of industry, academia and the federal government to brainstorm ideas and to agree upon the necessary and desired components for such a pilot program. This document captures the decisions made at that meeting, and provides guidelines for implementing the pilot program.

The high level goal of this pilot program is to develop and demonstrate a sustainable, scalable and replicable model for accelerating and broadening use of modeling, simulation and analysis (MS&A) in Midwestern SMEs through a public-private partnership (described below). Funding will be provided as seed money for this pilot program, with the expectation that it will demonstrate a path toward long-term sustainability. This is only achievable if (a) the supply chain members can rapidly reach a point where the results produce cost-benefits that allow and incentivize them to continue use of MS&A, either independently or within the continued context of the pilot program, and (b) software vendors can develop a business model that provides easier and more affordable access to software tools for SMEs.

The longer term goals of this pilot program are to put U.S. manufacturing on a path toward using MS&A for digital prototyping of new and existing products and for process manufacturing. Also, we expect this pilot program to be a demonstration of effective coordination that will be used in the startup of other regional centers.

The current level of MS&A across the manufactures in the U.S. is greatly varied with the companies lying at one of the three levels; entry, advancing, and expert. The key points are that U.S. manufacturers are at different levels in their adoption of MS&A in their processes, and that a natural progression of adoption and expertise exists to either adopt or advance usage to the next level. The focus of the pilot program is on the first two levels:

• Entry level—supply chain manufacturers who currently have no capabilities in MS&A, but recognize the benefits as a way to increase their competitive advantage.

• Advancing—supply chain manufacturers who currently have some initial capability, but want to become more advanced in their use of MS&A to promote innovation and ensure their long-term competitive advantage.

This early pilot program laid the groundwork for the formal recognition of the pilot program as a partnership with the U.S government. In March 2011, a Memorandum of Understanding was signed at a White House Ceremony, formally establishing the public-private partnership (PPP) known as the National Digital Engineering and Manufacturing Consortium (NDEMC) for five years. The Council on Competitiveness became the lead partner for the project, in collaboration with a number of other stakeholders. The Consortium is funded by a public-private partnership established by the United States Government and a number of participating OEMs. This funding partnership has the U.S. government giving $2 million and the private sector contributing $2.5 million to the project. Some of the companies backing the project include Deere & Company, General Electric, Lockheed Martin Corporation and Proctor and Gamble.

The NDEMC's main purpose is to pilot programs that promote adoption and advancement of modeling and simulation (MS&A) and high performance computing (HPC) among small and medium-sized manufacturers (SMEs) in the United States. The network of OEMs, manufacturers, solution providers, and collaborators that make up the NDEMC will result in accelerated innovation through a powerful collaborative ecosystem of like-minded organizations.

NDEMC is energizing the growth and development of small- and medium-sized American manufacturing enterprises (SMEs) by promoting public-private partnerships and encouraging skills transfer of advanced manufacturing techniques and processes that leverage computational power, simulation and cutting-edge modeling techniques. With funding through the Economic Development Administration, and as the initial project of President Obama's Advanced Manufacturing Partnership, the White House and the Council on Competitiveness are leading the effort to collaborate with SMEs to use modeling and simulation.

NDEMC brokers and promotes collaborative relationships that will sustain the growth of American manufacturing through jobs creation and enhanced competitiveness. NDEMC provides modeling, simulation and analytics education and training, access to High Performance Computing (HPC) and access to Software as a Service (SaaS). These services will be available through a distributed application to make U.S. SMEs more competitive in the global marketplace.

A great example of how NDEMC has positively impacted U.S. companies is the case of Jeco Plastic Products LLC. Jeco Plastic Products, LLC is a small custom-mold manufacturer of large, complex, and high-tolerance products with a plant in the Indianapolis area. Two processes are used in the manufacturing facility—rotational molding and twin-sheet pressure. Jeco's customer base includes large U.S. and international original equipment manufacturers (OEMs) in the automotive, aerospace, printing and defense industries. To take advantage of a monumental opportunity to secure a large OEM account, Jeco Plastic Products required high performance computing (HPC) and modeling, simulation and analysis (MS&A) resources to successfully evaluate design scenarios and predict the product performance of a complex custom pallet. In house finite element analysis (FEA) software and computing resources were inadequate to

accomplish this task. Jeco joined the NDEMC program to gain training, experience, access to university expertise, software and hardware to successfully compete against large foreign competitors. By employing HPC simulation, the company was able to simulate and analyze their pallet in a highly predictive and time-efficient manner. Without these HPC resources, they would not have earned a multiyear contract from a large German automotive OEM.

Improvements to Jeco's pallet product have impacted their bottom-line as sales revenue is expected to double, payroll will increase by 35 percent at their plant, and they will be in contention for additional high-margin, domestic and export business projects.

Overcoming Technical Challenges with High-Impact Computing Jeco experienced a technical challenge in its simulation of complex, high tolerance designs in inhomogeneous anisotropic materials, which is virtually impossible to produce with the current commercially available software. Tedious trial-and-error physical design and testing was deemed inefficient and would not meet the expectations of their large automotive OEM client. High-ranking executives at the company were cognizant that they needed to upgrade their MS&A capabilities to effectively compete in this high growth niche industry.

A last minute requirement for a multi-year project with a major German OEM required Jeco to take immediate action to upgrade. The critical situation prompted the company to contact Purdue University for assistance through their Manufacturing Extension Partnership (MEP) program, which led to becoming part of the NDEMC Midwest Project. Jeco understood that the relatively small cosmetic alteration required by their client could potentially affect critical specifications for deflection, and they needed outside assistance. To facilitate this change and receive the initial order, they had to rapidly analyze a very complex design before making the

expensive, irreversible tool changes. Access to HPC and the Purdue support staff were invaluable resources in enabling the company to make quick and accurate evaluations for the final step in the design process. Jeco CEO Craig Carson learned that the NDEMC public-private partnership would be instrumental in accessing the training, hardware and software necessary for MS&A.

Based on their limited resources, Jeco's participation in the NDEMC project became imperative to meet their strategic organizational, product and financial objectives. NDEMC's Midwest Project offered Jeco access to Purdue's faculty and staff. Jeco's leadership valued the university's strong collaboration, unwavering support and intellectual insight to assist them in bringing technological improvement to their pallet product. The program also introduced the company to superior test facilities for a wide range of applications. This included utilizing HPC simulation paired with laboratory materials test equipment at Purdue to validate their models.

From an MS&A perspective, NDEMC facilitated Jeco's access to software which ordinarily would have been beyond the realm of possibility due to budgetary constraints. By gaining access to MS&A and technical expertise, Jeco had the ability to develop creative technological solutions in the final, time-critical phase of the product innovation process.

Based on current projections, Jeco management is expecting a reasonably steady increase in incremental, cumulative sales revenue for rotational molding between 2013 and 2022, totaling nearly $23 million during the period. These projections are based on a full-scale release of a new product for their German OEM customer and additional projects in the twin-sheet thermoforming market. Due to increased production demand from their large clients, Jeco is expected to increase payroll and hire 15 advanced manufacturing workers within the next few years.

While we celebrate the successes and learn from the challenges of the Midwest pilot program, NDEMC continues to move forward. I am pleased to share with you that the NDEMC program received the HPCwire Editor's Choice Award for Best HPC Collaboration Between Government and Industry in 2012. Currently the NDEMC pilot program is wrapping up its federal funding and the Council on Competitiveness and other key NDEMC stakeholders are working to move NDEMC from a public-private partnership to a non-profit entity which would be the conduit for new partnerships, including new public-private partnerships, across the United States which will continue to work together to sustain America's manufacturing and competitiveness. The EDA and its partners will study the economic impact of technology-based innovation infrastructure toward boosting the long-term job capacity and competitiveness of U.S. manufacturing and industry.

Thank you.

For further information on the National Digital Engineering and Manufacturing Consortium please visit www.ndemc.org.

For further information on the Council on Competitiveness and its manufacturing work, including the US Manufacturing Competitiveness Initiative and the American Energy & Manufacturing Partnership, please visit www.compete.org.