Executive Summary of NIST-AMTech Roadmapping Workshop on Sustainable Manufacturing held November 13-14, 2014 at University of Kentucky, Lexington

Presented herein are the extracted highlights of a roadmapping workshop on ***Sustainable Manufacturing – A Business Perspective.*** Sustainable manufacturing, traditionally, deals with the development of products that are energy efficient and environmentally responsible across their lifecycle – using processes that value sustainability attributes. We embrace that definition, and emphasize a strong belief that sustainable manufacturing will never be fully achieved if addressed as a singular objective. However, it can be achieved as part of a business equation that values all aspects of a triple bottom line of economic, social, and environmental optimization. In emphasizing the business case, this document seeks to place sustainable manufacturing in a position as a major element of an environment for integrated product realization that optimizes every decision across a product lifecycle.

The body of work is sponsored by the University of Kentucky, Institute for Sustainable Manufacturing (ISM), and funded by a grant from the Advanced Manufacturing Technology Consortia (AMTech) program of the National Institute of Standards and Technology (NIST). Through this activity, the ISM is launching the Partnership for Research and Innovation in Sustainable Manufacturing (PRISM). PRISM will build on the foundation of this roadmap and the followon activities to create a continuous process of awareness, prioritization, selection, and execution of important R&D projects. These projects, led by industry, will deliver solutions that enhance the global competitiveness and sustainability of the U.S. manufacturing base.

The Sustainable Manufacturing Roadmapping Workshop addressed the three elements of sustainable products, sustainable processes, and sustainable systems. Small groups were assigned to each of the three elements and were led through a methodology for defining the current state and compelling needs, the vision, and the solution set for all topics related to their element. In total, 71 solutions were defined by the three small groups. These 71 solutions were prioritized and combined to identify 12 key Imperatives that represent the key findings for the workshop and the focal points for this work going forward. It is emphasized that the key findings came directly from evaluation and prioritization of the workshop content, and the rollup does not diminish the importance of the richer discussion or the components that are captured in the full text of over 100 pages which is available at: **http://www.ism.uky.edu/.**

The twelve key Imparatives emerging from the PRISM Roadmapping Workshop include:

Key Imperative 1: Sustainable Manufacturing Education and Workforce Development: Comprehensive Academic and Industrial Curricula for Sustainable Manufacturing Integrated with Opportunities for Work Experience for Education and Training of the Next Generation Manufacturing Workforce

Key Imperative 2: Next Generation LCA and Decision Support Toolset: Toolset that Supports Interactive and Integrated Affordable, Accessible Applicable, Actionable, and Scalable Product Lifecycle analysis. 2

Key Imperative 3: Corporate Asset Management: Management of Corporate Assets for Sustainability across the Enterprise, Including the Sustainability Footprint for Equipment and Facilities

Key Imperative 4: Risk, Uncertainty, and Unintended Consequences for Supply Networks: Comprehensive Risk Modeling and Mitigation Tool for Supply Network Management that also Addresses Uncertainty and Unintended Consequences

Key Imperative 5: Product Lifecycle Management (PLM) Capability for Process Planning: Enhanced COTS CAD/CAM Tools for Model Development and Product & Process Sustainability Analysis for Process Planning

Key Imperative 6: Public-Private Partnership for Sustainable Manufacturing: Public-Private Partnership for Data-Driven Sustainability Science in Manufacturing supporting holistic product/process/system optimization for best economic, social, and environmental value.

Key Imperative 7: Lifecycle Cost Models: Total Life-Cycle Process Cost Models that Reflects True Value and Support Total Value Optimization for Sustainable Value Creation

Key Imperative 8: 6R$_1$ End-of-life Management: Management of End-of-Life Products with a 6 R Emphasis and OEM Responsibility for Greater Economic Returns

Key Imperative 9: Flexible and Scalable Manufacturing Alternatives: Flexible and Scalable Manufacturing Alternatives Including Localized Manufacturing and Multiuse Systems with Customized/Personalized Manufacturing for Improved Sustainability

Key Imperative 10: Sustainable Manufacturing Metrics: Sustainable Manufacturing Metrics to Accurately Define and Reflect Sustainability Values

Key Imperative 11: Information - to Knowledge - to Intelligent Sustainable Manufacturing: Transforming Information to Knowledge and Application in Realizing Intelligent Design, Manufacturing, and Lifecycle Support

Key Imperative 12: Secure Information Exchange and Collaboration: Secure Collaboration Platform to Assure That Information That is Critical to Enterprise Success Is Provided to All Who Have and Authorization and Denied to All Others.

Path Forward

The University of Kentucky and its partners will host a series of workshops in the spring and fall of 2015 that will build on this roadmap and key Imperatives to define specific projects and constituencies for PRISM. The workshops will seek sector-specific consensus regarding needs and solutions, and will launch the methodology for continuous prioritization, project selection, and execution. Details of these workshops will be released in February, 2015.

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Workshop Registration (Register early for this limited seating event!):
http://www.ism.uky.edu/events/aviation-sustainable-manufacturing-workshop/