

NIST Visiting Committee on Advanced Technology

Recommended Design Principles for AMTech

February 7, 2012

1. Introduction

At the June 2011 meeting, the NIST Director asked the NIST Visiting Committee on Advanced Technology (VCAT) to provide recommendations on how NIST can best support advanced manufacturing in the United States. A Subcommittee on Advanced Manufacturing was formed to tackle this area, chaired by Alan Taub. Other VCAT members that participated were Uma Chowdhry, Paul Fleury, Tony Haymet, Karen Kerr and Alton Romig. External subject matter experts were invited to participate in the subcommittee meetings and provided valuable perspectives. They are acknowledged in the Appendix.

The Subcommittee first examined the newly proposed Advanced Manufacturing Technology Consortia Program (AMTech), with the objective of providing recommendations on the Design Principles of the new program. The Subcommittee conducted its business at the June and October VCAT meetings in Gaithersburg, as well as through teleconferences and email. This document summarizes the Subcommittee's conclusions and recommendations approved by the full VCAT.

2. Advanced Manufacturing Technology Consortia Program

The Advanced Manufacturing Technology Consortia (AMTech) is designed to fill a critical funding gap for early stage technology development by incentivizing the formation of and providing resources to industry-led consortia that will support basic and applied research on long-term, precompetitive and enabling technology development. AMTech is a new program in the President's fiscal year 2012 budget, which has not yet been approved as of this writing. The AMTech program's vision is consistent with the findings and recommendations in a recent report¹ by the President's Council of Advisors on Science and Technology (PCAST) and the President's Innovation and Technology Advisory Committee (PITAC). The report emphasizes the critical importance of advanced manufacturing in driving knowledge production and innovation in the United States. The PCAST researched the current state of manufacturing and concluded that U. S. leadership in manufacturing is declining, and that this is detrimental to the well-being of the Nation overall.

The AMTech-supported consortia will enable technology development and create the infrastructure necessary for more efficient transfer of technology. By convening key players across the entire innovation lifecycle, AMTech consortia will work toward eliminating critical barriers to innovation, increasing the efficiency of

¹ *Report to the President on Ensuring American Leadership in Advanced Manufacturing*, PCAST Report, June 2011, <http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-advanced-manufacturing-june2011.pdf>

domestic innovation efforts and collapsing the time scale to deliver new products and services based on scientific and technological advances. This strategy has the potential to drive economic growth, enhance competitiveness and spur the creation of jobs in high-value sectors of the U.S. economy.

3. Subcommittee Recommendations

The Subcommittee strongly endorses the AMTech Program as a model public-private partnership program for supporting technological innovation and facilitating its deployment to support advanced manufacturing. The Subcommittee's specific recommendations regarding the design principles for AMTech are summarized in the following sections.

3.1 Management Models

Management models for consortia can dictate their success or failure. The Subcommittee looked at a number of management models to determine which would be most effective for public-private partnerships, especially with respect to facilitating development, diffusion, technology transfer and adoption of knowledge as well as for facilitating participation by small manufacturers. One which stood out was the Semiconductor Research Corporation's Nanoelectronics Research Initiative (NRI). The NRI has leveraged modest Federal funding with significant co-investment from state and local governments along with industry partners to establish regional research centers. Educational institutions also participate in NRI.

Recommendation: As a starting point, the Subcommittee recommends that AMTech be managed through consortia, led by industry, that include broad participation by universities and government agencies.

The participation of small firms can be encouraged through a series of mechanisms, such as

- tiered membership within consortia (e.g., having sliding scale of dues),
- having weighted voting rights within the consortia,
- having them perform research tasks,
- providing access to specialized shared facilities and
- giving special consideration during the selection process for consortia led by small firms.

3.2 Performance Goals and Evaluation Criteria

The Subcommittee considered the definition of appropriate performance goals and evaluation criteria on various fronts: for the overall AMTech Program, for selecting awardees (e.g., consortia) and for measuring the performance of the awarded teams.

Recommendations:

The Subcommittee recommends the following evaluation criteria for the overall AMTech Program:

- Identification of critical gaps (e.g., technology, skill sets, etc.) in manufacturing that are common to an industry or sector.
- Creation of roadmaps² that guide new research and development to address industry problems.
- Ability to attract and leverage participation by multiple government agencies (including state and local governments), industry members and universities. A key criterion is the amount of resource commitment and leveraging that is attracted.
- The Program's awardees produce well-founded plans for the R&D life cycle, including technology diffusion, path to commercialization and their execution. Participation by the full supply chain is desirable.
- Creation of platform technologies that accelerate advancements in key manufacturing areas to dramatically increase U.S. competitiveness.
- Solutions are generated that address roadmap opportunities and hold potential to lead to commercialization, with creation or retention of U.S. jobs.
- High-value technologies, automation technologies and/or embryonic technologies, with the potential of retaining jobs in the U.S. manufacturing sector versus exporting jobs overseas based on technologies created in the United States.
- Positive impact on sustainability of the environment.

Excellence of the proposals should be the primary criterion for their selection. The Subcommittee proposes that the evaluation criteria used by NIST for selecting awardees include consideration of the following aspects:

- The team's proposal shows evidence of a clearly articulated vision for developing roadmaps or other means of identifying technology challenges that are suited to AMTech Program. Specifically, the AMTech Program seeks proposals that demonstrate innovativeness and the potential for having significant impact on U.S. competitiveness.
- The proposing team's participants have a successful track record in carrying out similar work.
- Breadth of types of entities included in consortium: the inclusion of small and medium manufacturers in the proposing team where appropriate or the consideration of their specific needs.

² Roadmaps should identify problems that need to be addressed—not solutions—and include the timeframes in which solutions need to be developed.

The Subcommittee recommends the following evaluation criteria for measuring the performance of the awarded teams:

- Attainment of stated goals and quality of scientific results: published roadmaps, research publications, formation of testbeds.
- Demonstration(s) of how research outputs address noted technology gaps.
- Effectiveness of management and/or oversight to ensure that goals are attained.
- Evidence of risk-taking in the technologies tackled.
- A vision that includes “grand challenges.”
- Successful inclusion of small- and mid-sized firms.
- Robust diffusion of technology and commercialization.
- Rigorous tracking and evaluation of economic/technical impacts.
- Amount of investment and resources leveraged from other government agencies (including state and local governments), industry members and universities.

3.3 Technology Focus Areas

The Subcommittee debated which specific types of technologies would make U. S. manufacturers more competitive globally. Ultimately, we agreed that the selection of investment areas should not be technology specific, but should be driven by the competitive criteria of the proposals. AMTech should support research in manufacturing process technologies, including fabrication of advanced materials, rather than the development of new product technologies.

Recommendation: The Subcommittee recommends that the focus of the Program should be on platform technologies that improve how manufacturing is done, or enable the manufacture of new products. There should be a balance of short- to long-term outputs. The consortia should address scale-up gaps that hinder a technology from being deployed for large-scale manufacturing.

3.4 Intellectual Property Rights

It is critical to the success of the AMTech Program that there be explicit principles for the management of intellectual property rights (IPR).

Recommendation: The Subcommittee strongly recommends that NIST develop guidelines for efficient Intellectual Property Rights management within the consortia.

3.5 Relationship to the NIST Research Laboratory Programs

As part of its charge, the Subcommittee also examined the Advanced Manufacturing Programs in the research laboratories at NIST. The Subcommittee finds that synergy with NIST lab capabilities is beneficial but should not be a requirement for judging the proposals.

Recommendation: The Subcommittee recommends that NIST laboratory leadership use the output of the AMTech process as input for their laboratory’s program development.

3.6 Other Challenges for the AMTech Program

Finally, the Subcommittee considered other key challenges that the designers and implementers of the AMTech Program should be aware of. These are

- Interactions with state, local and other economic development agencies.
- Influence of mission-specific federal agencies.
- “Messaging”—conveying that this program is not picking winners and losers.
- Ensuring that U.S. manufacturers gain competitive advantage.
- How to measure the benefit of the AMTech program to the United States.
- In this global economy, how do we address the competitiveness of
 - U.S.-headquartered firms,
 - U.S. “owned” firms,
 - any firm with substantial U.S. research and manufacturing facilities,
 - domestic content of products.

4.0 Conclusions

The Manufacturing Subcommittee of the NIST VCAT finds that the proposed AMTech Program would be a valuable addition to the portfolio of NIST and of benefit to the U.S. competitiveness in advanced manufacturing. The recommendations provided herein, approved by the full VCAT, are intended to strengthen the AMTech program and ensure that its benefits to the competitiveness of the U.S. industry be maximized.

Appendix - Expert Consultants Supporting the Manufacturing Subcommittee

The Manufacturing Subcommittee is grateful for the thoughtful input provided by the following manufacturing experts who participated in the subcommittee's meetings:.

Robert Atkinson (Information Technology and Innovation Foundation)

Bob Doering (Texas Instruments)

Steve Glickman (National Economic Council)

Jim McDougle (Council on Competitiveness)

Jason Miller (National Economic Council)

Chris Mustain (Council on Competitiveness)

Mark Rice (Maritime Applied Physics Corporation)

Cem Sarayder (General Motors)

Susan Smyth (General Motors)

Steve Zimmer (USCAR)