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Sent: Tuesday, September 20, 2011 1:20 PM
To: amtech
Cc: 'Stephen Cross'; 'Monique Tavares'; 'ben wang'
Subject: AMTech Comments

On behalf of the Georgia Institute of Technology and Stephen E. Cross, Ph.D., Executive Vice President for Research, please accept the following comments to the NIST AMTech RFI. These comments are also included in the document attached.

Comments in response to:

National Institute of Standards and Technology
[Docket No.: 110620345–1331–02]
Request for Information on How To Structure Proposed New Program:
Advanced Manufacturing Technology Consortia (AMTech)

Submitted by:

Stephen E. Cross, Ph.D.
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Georgia Institute of Technology
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Date: September 20, 2011

Thank you for the opportunity to provide comment on the proposed AMTech consortia program. Georgia Tech has a long history of industrial engagement, which ranges from basic and applied industrial research to direct assistance in process innovation and product development. One of the mechanisms commonly used at Georgia Tech to engage with industry is industrial consortia. Georgia Tech manages consortia associated with a number of its industrial research centers including the Rapid Prototyping & Manufacturing Institute within the Georgia Tech Manufacturing Research Center, the Georgia Tech 3D Systems Packaging Research Center, and the Georgia Electronic Design Center to name just a few.

We believe that industrial consortia play an important role in providing market-driven direction for the research and development work undertaken by our centers. The industrial members of our consortia help ensure real-life applicability of our applied research programs and they are engaged in the commercialization activities resulting from this work, which helps to fulfill the longstanding economic development mission of the university. One thing we have learned over the years in managing industrial consortia is the need for flexibility in the organization, management, intellectual property, and funding mechanisms to achieve long-term viability and success. One size does not fit all. We would encourage NIST to allow as much flexibility as possible in the structure and membership of the proposed AMTech consortia.

The following provides feedback on the specific questions listed in the RFI:

1. Should AMTech consortia focus on developments within a single existing or prospective industry, or should its focus be on broader system developments that must be supplied by multiple industries?

Both types or combinations should be allowed as there are strengths and weaknesses to either approach. Consortia focused on broader system developments will facilitate greater cross-pollination of ideas and expertise, and greater collaboration across industrial sectors, if the members can identify a set of cross-cutting, pre-competitive technologies. Consortia of this type will also have less issue with IP sharing compared to industry-specific consortia. Industry-specific consortia have a greater cohesiveness of advanced manufacturing issues and implementation mechanisms. Whichever way NIST goes, AMTech consortia should use a broad definition of the industry so that the consortia can focus on broad manufacturing system developments and broad manufacturing technology challenges and include the major participants in the industry's value chain. It is also recommended that consortia for traditional industries such as food processing and pulp and paper be included. Traditional industries have great needs and applications for adopting advanced manufacturing technologies and could benefit considerably from the program.

2. Who should be eligible to participate as a member of an AMTech consortium? For example, U.S. companies. *i.e.,* large, medium, and/or small; institutions of higher education; Federal agencies; state, local, and tribal governments; and non-profit organizations?

Broad flexibility in entity types for membership in AMTech consortia should be allowed and encouraged. An industry-led consortium should involve large US-based manufacturer(s) with flexibility to include all sizes of companies to ensure participation by the entire manufacturing infrastructure needed. Membership costs should be graduated to reflect the size of the participant. In addition, participation by all types of higher education institutes should be allowed; however, preference should be given to those institutions capable of providing shared manufacturing prototyping and demonstration facilities. Participation by Federal agencies, state and local government, and non-profit organizations should not be restricted, but membership should be based on the entity's ability to provide value-add to the technology development through infrastructure or cost share contribution.

3. Should AMTech place restrictions on or limit consortium membership?

No restriction except that the lead industrial firm should have primary operations in the U.S. or should have clear ability to create U.S. based manufacturing jobs. Non-lead consortium members from outside the U.S. should be allowed so as not to unduly restrict capabilities of the consortium.

4. Who should be eligible to receive research funding from an AMTech consortium? For example, U.S. companies *i.e.,* large, medium, and/or small; institutions of higher education; Federal agencies; state, local, and tribal governments; and non-profit organizations?

Two models are possible for consortium operation. The first model restricts research funding to consortium members with in-house research and development capabilities. The second involves creation of a research agenda and issuing solicitations for proposals from universities and other research providers. It is recommended that flexibility in funding with both models be allowed, but that funding to consortium members be given higher priority and that a sustained member-outreach program be included to gain needed expertise within the consortium.

5. What criteria should be used in evaluating proposals for AMTech funding?

Past experience suggests that there are substantial hurdles in creating a successful industry consortium. Examples of these hurdles include lack of trust, lack of leadership, inter-firm cultural differences, conflict persistence, and lack of structure. (Source: Larry D. Browning, Janice M. Beyer, Judy C. Shetler. (1995). Building Cooperation in a Competitive Industry: SEMATECH and the Semiconductor Industry. The Academy of Management Journal 38(1), 113-151.) Therefore, the extent to which these issues have already been addressed would enable the program to proceed apace.

6. What types of activities are suitable for consortia funding?

Consortium funding should allow support of consortium administration, marketing, general operations, and cost-share funding of research grants. Depending on the industry, special equipment for the consortium and access to equipment at the NIST laboratories will be needed and should be allowed. One approach would be to consider an AMTech Consortium as a "virtual national lab", so that any activity of a national lab would also be appropriate for a consortium.

7. Should conditions be placed on research awards to ensure funded activities are directed toward assisting manufacturing in the U.S.?

Yes, funding should be conditional on supporting manufacturing in the U.S. Research awards should show clear benefit to advancing a manufacturing technology need for a U.S. industry. Further, no less than 75% of each research award should be directed to entities with U.S. manufacturing operations.

8. What are ways to facilitate the involvement of small businesses in AMTech consortia?

Small business participation is needed to expand the consortium's technology ability and to help ensure that the entire "food chain" of companies needed to provide the manufacturing

infrastructure is involved. A successful Federal program, NSF ERC, requires that small businesses be embedded in every ERC enterprise for translational R&D. Small business involvement could be facilitated by requiring all consortium funding requests to clearly outline involvement with the various segments of the manufacturing infrastructure. In addition, small business participation could be facilitated by encouraging the lead-industry member(s) to include companies in their supply chain to be a part of the consortium proposal and subsequent membership. Other approaches to facilitate the involvement of small businesses in the consortia include sliding monetary contribution requirement, utilization of the NIST Manufacturing Extension Partnership for membership marketing and direct consortium membership and encouragement/requirement of partnership with small businesses in certain solicitations or research programs.

9. What are best practices for facilitating the widest dissemination and adoption of knowledge and technology through consortia?

Consortium best practices for wide dissemination and adoption should include:

- **An active membership expansion program**
- **Publication of a consortium periodical to general manufacturing audience to highlight research focus areas and accomplishments**
- **Publication of consortium based results in a broad spectrum of appropriate science and trade journals.**
- **Fair and open IP policy that benefits all consortium members**
- **Consortium advisory board that includes membership from a variety of industry sectors**
- **Annual conferences/symposia rotating among member sites**
- **Website with member-only sections and public access sections.**

10. While it is expected that the research efforts of AMTech consortia (including participants from the Federal, academic, and private industry sectors) will take place largely at the pre-competitive stage in the development of technologies, the generation of intellectual property is possible, and even likely. What types of intellectual property arrangements would promote active engagement of industry in consortia that include the funding of university-based research and ensure that consortia efforts are realized by U.S. manufacturers?

Intellectual property arrangements should be structured to allow the broadest use of technology developed from consortium funding first by consortium members on a royalty-free basis for a fixed period of time and then by any U.S. based company through licensing agreements with the consortium. All industry consortium members should be paying members. Levels or "shares" could be established to provide greater voting rights for research direction; however, all consortium members should have equal access to technology developed.

11. Would planning grants provide sufficient incentive for industry to develop roadmaps and initiate the formation of consortia? If not, what other incentives should be considered?

Yes, planning grants should be sufficient to encourage both industry and university involvement in consortium formation planning. Various industry associations have developed technology roadmaps and these mechanisms should be leveraged such that the research addresses industry roadblocks.

12. Should each member of an AMTech consortium be required to provide cost sharing? If so, what percentage of cost sharing should be provided?

Yes, each AMTech consortium member should provide direct funding or cost-sharing to the research activities of the consortium. Flexibility in the type of direct funding or cost-sharing by industry, university, non-profit, or governmental entity should be allowed. Cost sharing by providing access to manufacturing facilities, laboratories, prototyping facilities and personnel services for same should be allowed. A sliding scale of cost share requirements should be encouraged to accommodate various member categories including small businesses.

13. What criteria should be used in evaluating research proposals submitted to an AMTech consortium?

Research proposals should be evaluated on several criteria including:

- **Likelihood of new manufacturing platform development**
- **Potential to transform an existing industry or create a new industry**
- **Commercialization potential**
- **Potential technology benefit across industrial sectors**
- **Resulting potential for U.S. based manufacturing growth**
- **Is the intent clearly stated and is entity capable to achieve research intent**
- **Traditional criteria (e.g., intellectual merit, novelty, capability of proposers, cost)**

14. What management models are best suited for industry-led consortia?

(see answer to question 20)

15. Should the evaluation criteria include the assessment of leadership and managerial skills?

Yes, leadership and managerial skills should be included in the consortium funding evaluation. An existing entity should be able to provide this directly. A newly proposed

entity could be evaluated based on the track record of the proposed management team by the new entity. Preference should be given to the leadership team proposed that could draw the participation of a wide range of industry sectors to work on the proposed topic/research area.

16. Should limitations be placed on the duration of consortia?

Consortia funding should be provided for a period of no less than five years, with the potential for 3-5 year renewals if success is shown. No time limit on the duration of a consortium should be instituted. The life of the consortium should be based on continued need for the topic area focus and on the consensus and interest of member funding. In successful cases, it is expected that consortia would become self-funding through membership fees and research grants after 6 to 10 years.

17. How should an AMTech consortium's performance and impact be evaluated? What are appropriate measures of success?

A consortium's performance and impact should be evaluated on the resulting improvements of a manufacturing platform or process technology, development of both pre-competitive and market ready technologies, market deployment of the technology, impact on a broad range of industry sectors, and improvement in manufacturing competitiveness of a U.S.-based manufacturing sector as measured by U.S. and global market share, manufacturing productivity, and technological superiority. An AMTech Consortium proposal should declare performance metrics and be held accountable to those measures.

18. What are the problems of measuring real-time performance of individual research awards issued by an industry-led consortium? What are appropriate measures of success?

It takes a length of time from when a technology is developed to when it is implemented. Other issues include differences in stakeholder expectations, indirect links between research interventions and desired outcomes, external factors (such as business cycles and policy developments), and the difficulty of developing counter-factual evidence or comparison groups to address what would have happened without the program. (Source: Jan Youtie, Barry Bozeman, Philip Shapira, (1999). Using an evaluability assessment to select methods for evaluating state technology development programs. Evaluation and Program Planning 22, 55-64.)

19. How should the NIST AMTech program be evaluated?

The evaluation metrics should be considered relative to a logic model of the program which incorporates phased outputs and outcomes. The first phase could involve short-term standard research metrics such as publications, patents, students hired by industry, and the

like. The second phase might be focused on mid-term commercial activity measures such as new products, processes, licenses, strategic alliances, venture capital. . The third phase might focus on specific company outcomes such as new products and processes and their outcomes, including sales, cost savings, and capital investment, followed by a broader analysis of industry-wide or economic benefits, such as return on investment and gross domestic product. (Source: Gregory Tassey (2003), Methods for Assessing the Economic Impacts of Government R&D, Gathersburg, MD: National Institute for Standards and Technology.)

20. What are lessons learned from other successful and unsuccessful industry-led consortia?

SEMATECH (SEmiconductor MAnufacturing TECHnology) and the Semiconductor Research Corporation. are examples successful industry-led consortia. The American Forest and Paper Association's Agenda 2020 Technology Alliance is also significant in its adoption of advanced manufacturing breakthroughs for a traditional yet important US industry. These successful consortia have in common several attributes including strong leadership by key large industry members, active engagement and membership of companies within their supply chain, dedicated leadership and management personnel, and a focus on removing existing roadblocks to progress with advanced manufacturing technologies. The experience of the state of Georgia with it's Traditional Industry Program can be characterized by strengths as well as weaknesses. This program successfully brought together companies in food processing, pulp and paper, and textiles into three consortia that issued RFPs for university research into problems that hampered the competitiveness of these industries. The program was state funded rather than funded by private industry and although an evaluation of the program found it to be effective in encouraging take-up of the technologies (see SRI International, Review of the Traditional Industries Program of the State of Georgia, 2005), the research tended to be focused on practical problems (such as reduction of waste) that did not cause competitive issues rather than on advanced manufacturing domains that would move the industry into a new level of competitiveness. Eventually the program lost its state funding.

21. How can AMTech do the most with available resources? Are there approaches that will best leverage the Federal investment?

Priority should be given to consortia that offer the greatest promise for new manufacturing platform development and impact on a broad range of industries. The greatest leverage of Federal investment will be achieved by selecting a consortium lead by a strong industry member or group of members that has the financial capacity and a strong commitment to the goals of the consortium. In addition, partnerships with existing consortia and federal agencies (such as the Semiconductor Research Corporation-NSF partnership) should be considered as a resource for collaboration.

22. How should AMTech interact with other Federal programs or agencies?

Funded consortia should align with and leverage existing (or planned) major manufacturing research initiatives of Federal agencies, e.g, NSF I/UCRC program.

23. What role can AMTech play in developing, leading, or leveraging consortia involving other Federal agencies?

Existing Federal consortia that have a manufacturing component should be evaluated for potential partnership with an AMTech consortium.
The Semiconductor Research Consortium and the National Science Foundation have developed good collaborative solicitations for research centers and individual programs in the nanotechnology domain. This collaboration would be a good partner for NIST.

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