

We at Purdue University believe that NIST's proposed Advanced Manufacturing Technology Consortia (AMTech) program will be a valuable tool to assist the US in driving manufacturing R&D toward tomorrow's opportunities and needs. A healthy, robust and upgraded manufacturing base is critical to long-term economic stability and international competitiveness.

We wish to respond to the initial questions, listed in the July 19, 2011 request for information.

**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?**

The consortia would be more effective if the decomposition was along a specific industry or a specific technology (with representation from the cross-section of industries where it was applied) dimension.

Without a specific focus the consortia may not be able to deliver tangible results.

**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?**

Assuming Federal funds will be used, it would make sense to keep the membership to US companies, academic institutions and other organizations. We need to encourage participation by all those who can add value to the advancement of manufacturing. It will be necessary to find ways to allow small and medium size companies to be active/viable members (modified membership fees or government support).

The decision on eligible participants should be left to the consortium's founding members. Industry sectors and common technology/system platforms will have unique characteristics that should shift emphasis for desired participants. For instance, in highly regulated industries such as pharmaceutical manufacturing, a strong argument could be made for federal agency participation, whereas federal agency participation may be less appropriate for secondary metal manufacturing or electronics. Likewise, the roles and responsibilities of supply base tiers will be unique to industry sectors. In general, participation should be open to all entities performing or supporting value adding activities.

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

The primary consideration should be the logical connection to the consortium (based on the industry or technology focus) and the potential contributions made by the members to the consortium. It might be necessary to modulate the mix of the membership (small, medium, large) to ensure that it does not get focused on issues specific to the size of the entities involved. There should be clear criteria for membership and minimum participation levels for membership. A member must be an active contributor to the AMTech consortium. The sign of membership may end up being controlled by the total quantity of the financial support. Membership should remain flexible to allow companies to participate at appropriate times and also to include newly developed technologies or new companies to participate after the consortium is formed.

**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?**

All member organizations should be eligible. It is suggested that each project have Principal Investigators representing a not-for-profit institution (e.g. a university) and an industry scientist/engineer. It may be necessary to sometimes support key technology providers who are not members of the consortia to complete a project.

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

Criteria should evaluate the ability of the proposals to meet one or more of the seven goals defined for the AMTech program. Weighting can be applied to emphasize key goals. Criteria should also include the requirement to document prior successful efforts related to AMTech program elements.

The ultimate criteria is manufacturing competitiveness and potential economic development. Some specific criteria could be:

- Potential for providing companies a competitive advantage in the next two to five years
- Number of companies that can potentially benefit
- Likelihood of the project occurring without federal funding (must not fund projects that will occur on their own)
- Buy in and partial funding, including in-kind, from manufacturers

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

The primary activities should be related to manufacturing infrastructure, capabilities that enhance the whole industry and 6.2 and above TRL. Emphasis should be on development (software & hardware) as opposed to research or implementation. The activities should be pre-competitive where possible. Possible examples are:

- Funding should be focused on those activities known to be required for the successful development of new manufacturing technologies where industry is either unable or unwilling to make the required investments.
- Targeting sectors that have moved off shore, with the objective of on-shoring. For example, electronics manufacturing
- Projects that can substantially reduce new product realization time, for example the design and production of complex molds, complex machinery, complex tooling
- Projects that facilitate the integration of product and process design, including supply chain
- Projects that address over burdensome federal regulations that inhibit investment in the US, for example, many FDA processes.

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

There needs to be safeguards against moving the technology developed here to factories owned by these organizations abroad – a milder version of export control measures. There could be some instances where a non-U.S. plant gets assistance indirectly.

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

Make involvement of small businesses a pre-requisite of awarding a consortium.

Couple the consortia with SBIR/STTR awards, providing additional support for small businesses (or expecting matching from large businesses – and not from small).

Small- to mid-size manufacturers have far less flexibility than OEMs and upper-tier manufacturers in releasing personnel from production related responsibilities to participate in consortia activities. Any steps that can be taken to mitigate this impact would increase SME participation. SME's also have problems accessing capital to implement new technologies.

Work with OEM's and get their supply chains involved. This is being used for example, in the Midwest Project (National Digital Engineering and Manufacturing Consortium). This method is well received by the supply chain because they know many others will be involved, thus they can share ideas.

In manufacturing sectors where companies do not sell to OEM's, work through trade associations or other networks to involve groups of companies.

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

Where possible, focus on pre-competitive technologies and require regular roundtables of all participants.

In many cases the HUB technologies are a good option for distribution. Three HUB examples include the Purdue University ManufacturingHUB, the Ohio Supercomputer Center, and the National Center for Supercomputing Applications.

The NIST MEP system is an excellent option for dissemination that requires face to face meetings.

Adoption of technologies will require significant efforts, and would be accelerated through publicly accessible technology commercialization centers, where for a minimal fee, non-participating companies and researchers could use prototype equipment or production lines to lower the perceived level of risk associated with a lack of understanding or applicability of newly developed technologies.

- 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?**

All members must recognize that everyone is better off with IP and projects should encourage and incentivize the development of IP.

The participants must be fully informed of the laws and regulations governing IP, the extent to which special arrangements in research contracts can assign ownership, etc.

If the goal is the utilization/deployment and adoption of technology/IP -- then it should be available royalty-free to members of the consortium. This will require all members to have made investments through member fees. These fees could be a cost share requirement. The issue of charter members versus later arrivals will have to be addressed.

The consortia could also grant awards totally funded by a member or specific members of the consortia. The IP from these efforts would be handled under separate contracts.

- 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, but planning grants cannot be the driving factors to establish a consortium. There needs to be a need in the sector to come together to solve a problem.

Planning grants are an excellent methodology, but should be competitive in the sense that planning grant activities will not always result in a full grant.

In some cases, already existing NIST and other federal studies, and private studies, have already developed roadmaps that can immediately addressed via consortia.

Incentives will be more effective in recruiting firms if the incentives provide a sustainable competitive advantage (e.g., early access to new technology requirements) or access to new customers (e.g., preferred supplier status given by OEMs to suppliers or potential suppliers who participate in roadmap development).

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

Without cost sharing there is no stake in the game for the players. This demonstrates the commitment of all members to the effort. The cost sharing should include a minimum level of cash. Total cost sharing from consortia members should be in the 25% to 50% range. Small companies and universities could contribute at a lower rate.

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

Research proposal criteria should include:

- Potential impact on manufacturing competitiveness in the US
- importance of the proposed effort to furthering the objectives of the roadmap
- quality of the proposal
- track record of the proposers

Review answer to question #5.

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

A large respected company should be the lead with a strong active Executive Committee/Board.

For large scale, industry-led consortia, the management team or entity should have extensive experience with federal agencies and funding programs, and be aware of the reporting responsibilities and unique operating – and more public nature –of publicly funded programs. The fiscal agent has to have experience with complex federal private partnerships. Many universities fit this criteria.

The consortia must have a highly competent and qualified project manager at 100% effort.

The consortia must have a long- term view and develop ongoing plans beyond the time frame of federal funding.

A version of the Sematech model, with university and other organizations as members is a possibility.

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

Yes, this is true for the fiscal agent and the project manager(s) if possible – usually project managers are not identified in the proposal stage.

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

No. The formation and life of consortia should depend on the questions/issues they are trying to address.

The Consortium proposal should probably include a plan for becoming self-sufficient. Government funding should likely be limited to 5-10 years.

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

Performance should be judged using metrics identified as leading indicators of success such as: 1) number of industry participants, 2) percentage of supplier tiers participating (e.g., if a supply base is defined as having 5 supplier tiers, the consortia should strive to have participation from

companies in all 5 tiers), and 3) performance to in-process milestones. Impact metrics should directly correlate to AMTech's stated goals. For instance, the first identified goal, "Promoting collective efforts that enable the development of key technology platforms and technical infrastructures" could have metrics such as proportion of funded efforts involving two or more companies, or number of consortium developed technologies adopted as standard operating procedures by industry participants.

Early on the metrics will have to be the IP, member retention, addition of new members, adoption of new methods or methodologies, for example a new design methodology for modeling casting processes, etc.

The next stage will be deployment of IP and economic impact. Where possible examine compiled investment, new products developed, time-to-market, market-share change, and other factors.

The ultimate metric is the US industry share on the global level for that specific technology or sector.

**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?**

This will be difficult. The intent of these consortia is to make US industry (and industry sectors) competitive in the long-term. Also, unless a project is to solve an immediate problem or technology gap, meaningful economic metrics will be difficult. Each project should have specific deliverables that can be measured.

The consortia should also plan to make positive impacts in the medium term time frame, up to five years. Projects to achieve this can be measured for practical results and if the results are implemented by the consortia private sector members.

**19. How should the NIST AMTech program be evaluated?**

Initially the program can be evaluated by the number of successful individual AMTech consortia that are created and are actively functioning.

The ultimate evaluation will be the aggregate impact of all the consortia.

NIST should develop a specific reporting requirement that will allow for value analysis. The economic performance and growth of consortia members should be followed. How does US manufacturing compete – trend?

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

Look at Sematech for potential successes and pitfalls.

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

Invest in manufacturing technologies that are impactful and/or widely utilized.

Require matching of federal funds with industry dollars.

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

Coordination for all manufacturing programs across the Federal agencies is essential to avoid duplication of efforts. The various federal agencies should establish an internal committee with NIST as the chair to review and monitor government wide manufacturing related programs. This could be the Interagency Working Group on Manufacturing Competitiveness. There should be an attempt to leverage each other's efforts/funds – an example would be NIST partnering with DOE on manufacturing technologies for energy intensive businesses.

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

See 22 – OSTP should create a NITRD type coordination body for manufacturing research – NIST could play a lead role in the creation and coordination of such an entity.

AMTech should provide real time communication to members of overlapping federal efforts and new funding opportunities. AMTech could facilitate introductions to related consortium members when appropriate and develop a shared communication space for consortium leaders to exchange requests and opportunities, and allow Federal agency personnel to lead topical forums involving related consortium leaders/ experts.

Where advantageous, AMTech should involve other federal programs as partners.

Where advantageous, AMTech should ask that specific consortia become partners in other federal initiatives for advanced manufacturing.