

From: Center for Hierarchical Manufacturing [mailto:chm@research.umass.edu]
Sent: Thursday, October 20, 2011 9:17 PM
To: amtech
Cc: watkins@polysci.umass.edu; wright@research.umass.edu
Subject: AMTech Comments

[corrected attachment]

Dear Dr. Lambis:

Please accept our comments on the proposed Advanced Manufacturing Technology Consortia Program (AMTech), submitted on behalf of the MassNanoTech Institute, a multidisciplinary research program on nanotechnology at the University of Massachusetts Amherst.

We appreciate the opportunity to provide input on this exciting program. It was also our pleasure to advertise the extended comment period to industry and academic attendees at a recent NIST-NNN workshop on Nanofabrication Technologies for Roll-to-Roll Processing that we led in Boston in collaboration with Chris Soles of NIST. We look forward to hearing more about the AMTech program over the coming year.

Sincerely,

James J. Watkins

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Response from MassNanoTech Institute (University of Massachusetts Amherst)

- 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?**

Developing precompetitive enabling manufacturing technologies through a program of funding focused research projects, the purpose of AMTech, would best be done by addressing broad technical platforms in which increasing American manufacturing competitiveness is critical, and not by isolating particular industries for benefit. AMTech should establish a strategic roadmap of industries where innovative manufacturing platform developments will have the broadest impact towards U.S. global competitiveness. In some cases, consortia may focus on an industry, such as displays, while in other cases focusing on a manufacturing platform, such as roll-to-roll processes, that may impact several industries. Consortia should also communicate regarding overlapping areas.

- 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?**

All organizations that share a common interest in the development of enabling manufacturing technologies that are the focus of AMTech's vision should be able to participate in some way within a consortium. While consortia should be industry-led, and while some aspects of consortia activity will be institutionalized programs involving certain sets of players (*i.e.*, funding of R&D projects at research-based organizations), the full adoption of advanced manufacturing technologies and the ultimate realization of economic growth and job creation will benefit most if all stakeholders are welcome to participate in appropriate ways. For instance, research universities may host centers of excellence in particular areas related to advanced manufacturing, and professional societies or trade associations may have excellent rapport with large numbers of technology leaders and manufacturing executives; participation of these organizations in consortia would be a positive addition. It may be beneficial to provide different cost-share structures for different sizes of companies, and to further provide incentives for collaborative manufacturing and product development.

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

Members should be U.S.-based companies and organizations. Potentially foreign companies could participate in consortia-supported R&D projects, but as non-members and only if they have a significant U.S. manufacturing presence. Members should have a demonstrated stake in the manufacturing platform or industry sector that is the focus of the given 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?**

The prime recipient of technical research funding from a consortium should typically be a research university or other private or non-profit research institution that employs Ph.D.-level research personnel and that will be engaging such qualified individuals in carrying out the project plan. Academic research institutions would be preferred over companies due to their inherent mission of

developing and disseminating knowledge. The prime recipient would be encouraged to collaborate with other entities (companies, government entities, etc.) for certain tasks under subawards and project teaming agreements. On the other hand, if a consortium was to award funding for non-research activities (i.e., training, evaluation, roadmapping activities, etc.) then certainly many kinds of organizations could be eligible to receive those funds.

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

The primary criteria for evaluating proposals for funding should include: (a) how well the proposed project conceives of a solution to a key challenge or technical hurdle on the consortium's roadmap, (b) a strongly convincing methodology for accomplishing the research objectives, (c) the quality and sufficiency of the proposer's team including researchers, collaborators, facilities and other resources, and (d) the proposed approach for demonstrating efficacy of the solution within a realistic manufacturing setting. Evaluation criteria should also consider the proposed project's impact on U.S. global competitiveness in a manufacturing technology or broad industry, the level of technical challenge, the breadth of impact to industries and applications, the commercialization opportunity, and the potential market size and share. Additional criteria could include the project's proposed impact on new manufacturing paradigms such as sustainability, reduced energy usage, green manufacturing, workforce retention and growth, and broad-based economic impact.

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

Assuming that consortia funding would be restricted to (primarily) academic research in advanced manufacturing, then suitable activities should include both basic and applied research in any discipline that can impact advanced manufacturing, as well as pilot studies and prototype development. Capital equipment over a certain value (for example, a \$1,000,000 limit) should not be funded through AMTech consortium projects. Activities should further include scalability assessment and demonstrations through pilot studies, and should involve partnerships to effectively facilitate this. Project budgets should be encouraged to include funds for independent evaluation of efficacy in actual manufacturing settings, to the extent that a research project is doing more than fundamental laboratory research.

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

Not only should direct funding impact primarily assist U.S. manufacturing operations, but proposals should be evaluated with this in mind. However, it would naturally be expected that published research and reporting of results through conferences and meetings would have international impact.

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

Offer proportionately lower consortium membership costs to smaller enterprises as compared to larger companies. For instance, our academic research organization operates an R&D consortium program for companies interested in roll-to-roll nanomanufacturing technologies, and we benefit from a state program that reduces by 50% the annual membership fee for any manufacturing company in our state for the first year. This is a particularly good incentive for smaller companies to get involved in the consortium.

Provide incentives for effective, fair joint venture or collaborative manufacturing agreements between small and larger companies. Include evaluation criteria seeking new innovations and infrastructure that benefit small companies predominantly if possible.

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

The Semiconductor Research Corporation's practice of collecting and making available technical reports from its funded university projects to its member companies is a useful model. In general, hold quarterly and annual meetings where project updates are detailed. Engage companies through roadmap development and updating of consortia focus, project efforts, and pilot demonstrators based on progress. Sponsor pilot demonstration facilities where research can be transitioned to benefit as many consortia members as possible. Provide consortia member accessible websites where updates can be posted.

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?

Assuring that businesses can retain title to inventions that they may generate in the process of participating on a university-led research project team under consortium sponsorship would help to promote active engagement of industry in consortia. Establish fair and open licensing methods between academic and non-profit research institutions and consortia members. Provide incentives for establishing reasonable guidelines for licensing manufacturing methodologies to members, and consider options and approaches when members include direct competitors within an industry. Sematech/SRC have established similar approaches via Albany NanoTech, for example.

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?

One global approach would be to hold a series of 'focus workshops' to establish a preliminary focus and range of topics for various consortia, and to attract prospective members, following this up by roadmap development processes for the consortia. Planning grants are necessary to get the right set of participants together, and supplemental grants would also assist as roadmaps are adjusted and as new members need to be accommodated or directions evolve within the consortia. In this manner, the consortia can make risk-based assessments and decisions that benefit all without being penalized.

Having a broad enough segment of industry participants, and ensuring that the participants are among the best qualified individuals nationally, in any roadmapping or consortia development program may be a challenge. It might be well to provide two tiers of planning grants: a small-scale Preliminary Planning grant to establish the scope and scale of effort and to form a broad team, and a larger-scale Development grant in which the hurdle to get this is a broad team with many highly qualified players willing to devote time during the consortium development or roadmapping process. In terms of incentives, AMTech should be willing to pay for travel expenses within certain bounds to make sure that the best people are able to get together for essential work sessions in the consortium planning and development process.

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

Cost sharing should be kept low enough so that small and medium sized enterprises do not find it an obstacle to participate. Academic institutions that join consortia should have no cost sharing

requirements. There should be a tiered cost match requirement such as 20% for small and medium sized companies, and 50% match for large companies. This insures that large companies won't dominate the funding, and further commits all to US manufacturing base and economic development. FFRDCs should be permitted to be consortia members but only if committing their own funding and resources for participation.

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

See response to Q.5

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

An established organization that has ample administrative capacity and experience should be selected to provide management services for each consortium. The consortium should be organized with a board of directors, which in turn hires a chief executive of the consortium, who serves as an employee of the organization providing the management services. Two general models for this type of management approach are the for-profit Association Management Company model and the not-for-profit model exemplified by the Semiconductor Research Corporation's management of the Nanoelectronic Research Institute consortium.

At an operational level, the following suggestions are offered. Establish sub-categories of focused R&D, with each category or module having a lead organization. Establish targets for each module on reasonably short (*e.g.*, six-month) timelines to demonstrate progress and adjust goals for next timeline. Each module could further include bi-weekly reporting and discussion of progress, challenges, etc. in order to facilitate group interactions within each module. Advisory panels/committees can be formed for six-month reviews of efforts and projects, and readjusting of program roadmaps and metrics as necessary. The approach should incentivize innovation and open dialogue and not penalize failure of risk-based approaches with potentially transformational impact.

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

Assuring that leadership and management skills are in place and being well-exercised is an important task of the board of directors of a consortium. NIST-supported consortia should indeed be evaluated from time to time, with the emphasis primarily on achievement of programmatic goals and consortium effectiveness. Perhaps consortia should be required by AMTech to carry out their own leadership and management review as a responsibility of the consortium's board of directors, and then during the AMTech evaluation process the evaluator verifies that this review indeed regularly takes place.

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

Consortia would presumably be national investments in advanced technology development in certain priority areas, shared with paying members of the nation's manufacturing community, so a certain amount of longevity should be expected. International competition demands that the U.S. make its investments for the long haul. Thus, selection of the consortia to be funded in the first place, and good evaluations meant to improve consortia capacity to deliver results and to be agile in adapting to new changes in the advanced manufacturing landscape, will be of paramount importance.

Ten-year limits on good performers would be a minimum to effectively impact U.S. manufacturing bases for the long term, and establish a new paradigm to the U.S. innovation cycle. As part of this

time frame, models for sustainability should be developed, and follow-on public-private partnership funding considered depending on the market opportunity, the U.S. global position and competitive landscape in the particular consortia focus, and the progress towards demonstrated innovation outcomes by the consortia. Five-year renewals should be conducted in order to avoid long-term commitment to non-performers. At a minimum, AMTech consortia will need base funding for at least 3-4 rounds of research grants plus the time required to see their final round of grants to conclusion. This would be the case for a consortium that has failed to demonstrate results and needs to be wound down.

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

One key measure of consortium success would be demonstrated attainment of roadmap technical challenges through consortium-funded research projects. By using a well-conceived and ambitious roadmap in the first place and by awarding research funding to critically-reviewed academic-led projects that aim for and hit progressively more advanced targets on the roadmap, it will be straightforward to measure consortium performance and impact on project technical attainment of roadmap objectives. Technology (pilot) milestones are also good measures.

One practical measure of consortium success could be manufacturing trials of consortium-funded academic research at the facilities of consortium members.

Other dimensions of performance and impact evaluation could include demonstration of technical innovation, effective technology transfer, IP licenses resulting from the consortium, process/product commercialization and, ultimately, U.S. economic impact.

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?

Depending on the timing, in a worst case the research results can occur at one point and not be fully showcased to members at a consortium meeting or in periodic reports for six months or more, and then follow-on research efforts on that same project or “field trials” in member facilities or test beds can add more months or even years to the time lag in terms of comprehensive performance measurement. This can be mitigated to a great extent by establishing secure collaborative project websites and other online collaborative tools to enforce ongoing technical discussion among researchers and industry stakeholders.

19. How should the NIST AMTech program be evaluated?

Demonstration of transitional technologies impacting commercial manufacturing in the U.S. Scope, objectives, and program goals should be specified up front, supported by program roadmap. Evaluation metrics can include scaling of processes, funds invested, industry commitments to methods, and other criteria within the commercialization value-chain. Evaluation metrics should be both quantitative and qualitative, with measurable impacts towards manufacturing in the U.S.

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

Consortia leadership should be by committee or board of directors, therefore a large company can’t dominate small companies as occurs with joint ventures many times. Provisions to add or remove members from consortia during the program should be allowed. Program tasks and efforts could be

modularized in order to evaluate specific progress of members towards goals and objectives of consortia focus areas, with means to adjust scope and participation in any task or subtask in real time.

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

AMTech should consider existing manufacturing and nanomanufacturing centers supported by various federal agencies and have them involved in a leadership role, nominally with consortia members initially including industry partners. Industries that have received other federal grants, loans, or tax incentives should be incentivized to participate (*e.g.*, battery, solar PV, EV, materials, etc.) in consortia where appropriate. State and regional initiatives and industry trade groups supporting consortia could also be given some weighting in decisions to fund particular consortia.

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

AMTech should mandate inclusion of related efforts by all federal agencies, including DOE and DARPA/DOD Innovative and Advanced manufacturing programs. Complimentary goals and themes of different agencies should be merged in order to exact the highest, most cost-efficient impact to U.S. manufacturing.

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

Coordinate a series of workshop with other federal agencies to evaluate and decide upon common objectives for manufacturing programs, leverage multi-agency funds to provide more effort and resources in order for consortia to achieve the broadest impact on all agencies and U.S. manufacturing global competitiveness. Coordinate a cross-agency consistent set of evaluation and performance criteria, and further provide incentives for consortia to establish and enact sustainable business plan models.