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To: amtech
Cc: Bob Pfahl; Carol Handwerker; Alan Rae; Olthoff, James K.; Goldstein, Barbara L.
Subject: AMTech Comments

Attached are the comments from iNEMI, the International Electronics Manufacturing Initiative, a highly successful key manufacturing consortium. I have been traveling extensively and am thus sorry for being one day late on the submittal. Please accept my apologies for the inconvenience and do give these inputs a serious review.

Best Regards

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Overview:

The Information below is in response to the request for comments to the AMtech program that was originally dated July 22nd, 2011. This program is **directly** aligned to the strengths and capabilities of iNEMI for the electronics manufacturing industry which is an area of critical competitiveness for the United States in R&D.

Background on iNEMI:

The International Electronics Manufacturing Initiative (iNEMI) is a nonprofit consortium whose mission is to:

Forecast and Accelerate Improvements in the Electronics Manufacturing Industry for a Sustainable Future.

This mission is directly aligned to the directive of the AMTech manufacturing consortia. iNEMI has been in place since 1994 and our major deliverables include the biannual development of the broadest and most comprehensive roadmap for the electronics manufacturing industry. With the recent publication of the 2011 iNEMI roadmap, we delivered the ninth version of our roadmap. Nearly 600 senior technologists and business leaders from across the globe representing 310 different organizations contributed their expertise and perspectives. One key deliverable from each publication cycle of our roadmap is a document that identifies the critical drivers and critical long term research priorities that must be addressed to further the competitive and compelling performance of the manufacturing electronics industry.

We also have a methodology of defining critical industry gaps and needs and then organizing and managing a proven methodology of collaborative R&D on complex manufacturing challenges. These collaborative teams typically have 10-15 companies and/or research institutes working in an aligned fashion on well defined goals and deliverables. We have four major areas of focus that cover the environment, miniaturization, medical electronics and alternative energy. Our collaborative R&D projects support those four areas of focus.

The INEMI membership is composed of 98 leading firms and research institutes from around the globe. In the electronics industry complex supply chain and distributed research environment it is critical to be able to pull together thought leaders from a diverse set of our members. The combined annual revenue of the iNEMI membership now exceeds $700B and it includes 42 leading firms in the US electronics business and 8 leading US research institutes. One of those 8 research leaders is NIST which is a very active iNEMI member. A ***sample*** *of member logos that drive key collaborative thrusts follow:*

There is Great Power and Leadership from within the iNEMI memebrship

Request for Information: The objective of this request for information is to assist NIST in the development of the new AMTech program should NIST receive FY 2012 appropriated funds for this purpose. In this connection, the questions below are intended to assist in the formulation of comments, and should not be construed as a Limitation on the number of comments that interested persons may submit or as a limitation on the issues that may be addressed in such comments. Comments containing references, studies, research, and other empirical data that are not widely published should include copies of the referenced materials. All comments will be made publicly available. NIST is specifically interested in receiving input pertaining to one or more of the following questions:

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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?

There are opportunities and needs in both sectors. For example, in a rapidly evolving industry such as photovoltaic systems, focus needs to be applied on areas such as major advancements on total system long term reliability. This will require in depth research in focused areas that create alternative technologies for thermal management, high power electronics interconnect structures, and major advancements in scalable cost effective manufacturing infrastructure. An example of needs where the benefits would cross industrial sectors is the development of truly

high performance under fill and adhesives for electronics. These efforts would yield benefits to the semiconductor industry, the raw materials supply chain for the critical materials, Alternative energy system designers, high speed rail, and high performance aerospace needs. It is critical, however, that the scope of the work and the goals that are articulated be defined clearly and specifically enough such that the collaborative teams stay focused on the end goals and have measurements of progress against the defined milestones. The iNEMI roadmaps and our well refined collaboration methodology have identified both types of needs and enabled us to work the process to get diverse teams to set measurable deliverables and manageable scopes of work.

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?

Clearly US companies ranging from small to large. Innovation in specific technology areas often comes from smaller focused companies. Yet the expertise to take ideas and turn them into high volume profitable businesses that create a demand for skilled work forces is the forte of the larger industry leaders. Research institutions are absolutely critical and key leadership labs such as NIST, DOE, the EPA, and NREL are also key players. Motivated state and local governments can play a key role in providing incentives and resources needed to create a well funded and directed effort and an environment for cooperative learning and advancement.

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

No, but I do recommend that you focus your efforts with organizations such as iNEMI where much of the critical pre work such as comprehensive technology roadmaps that are tied to critical product sector needs, already exist. And the ability to manage effective collaboration of a diverse set of supply chain and research partners is essential. The iNEMI methodology has been refined over 16 years and is working efficiently. That is a rare and valuable skill and expertise for your chosen consortia membership.

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 of the above and potentially international research partners that are required to effectively execute supply chain wide R&D. That will be required, at times, to enable a successful, competitive, and deployable set of key technologies.

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

Linkage of research and deliverables to targeted industrial sector and product sector needs. There should be clear ties of the applied research in support of such things as mega trends (mobile society, security, human health, critical resource management and preservation, societal environmental needs) and to critical product sector needs such electric vehicles, high performance and cost effective portable imaging products for deployment in remote less affluent

regions. We have sample collaborative projects in medical electronics being led by firms such as Boston Scientific and Research institutes such as the University of Maryland for example.

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

In depth collaborative industry and academic studies and development of capabilities that support environmental areas of focus (carbon reduction, rare earth metals infrastructure development, substitutes and recycling for example), medical electronics materials development and modeling/simulation, automotive lighting and power systems, and highly efficient alternative energy systems. iNEMI has up to date technology roadmaps and gap analysis in all of these areas. Our Program on Rare Erath metals, for example, is led by IBM and has very active support from organizations such as Purdue University, HP, Intel, Cisco, Alacatel-Lucent, Agilent and RIM actively involved.

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

Direct them towards assisting product research and development that leads to competitive supply chains and manufacturing capabilities for US based firms and facilities. Note that the entire supply chain will require integrated support from non US based partners.

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

Market the technology and business opportunities through well constructed workshops, seminars and webinars. Identify targeted small and larger business players and specifically assign contact responsibility to consortia leaders to go pull them into key events and reviews. This too is a proven strength of iNEMI through our well developed network of technologist and business leaders.

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

Situation dependent but examples will be: white papers on industry positions and key technical findings, the generation of materials specifications and test requirements that ensure broad supply chain alignment, opening up consortia membership to all targeted key players in the industry with clearly defined information management guidelines. All of these techniques and more are built into the iNEMI collaborative R&D management system and methodology. One example of this is the in depth analysis of alternative laminate materials in the areas of Halogen Free Flame Retardants. This environmentally responsible focus is being led by Intel with support from 20 companies up and down the supply chain in electronics. One deliverable is a data sheet specification which must be completed by all suppliers in the future that provide in spec halogen free materials. Key US players include Cisco, Delphi, HP, Dow Chemical, that are working in concert with an international set of laminate, chemicals, and printed circuit board suppliers to ensure a smooth industry transition.

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?

The iNEMI project statements require participants to define, prior to the initiation of a project, two key aspects of intellectual property. First, participants must identify if they have existing background IP in the subject area and how it will be handled. Options are to disclose and open up options to license the technology, disclose but not open licensing options, and to not disclose. Secondly, there is a requirement to spell out how IP generated within the collaborative R&D project will be handled and how information and knowledge generated by the project will be shared. The key to success is that the project team member firms/organizations are accountable for defining up front how IP will be handled, and iNEMI ensures this disciplined requirement is completed and signed off by all project members prior to project approval .

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?

By definition planning grants will delay the start of critical collaborative research. Taking advantage of the already completed and developed iNEMI roadmap will both cut 1-2 years off of the front end schedule, and reduce the need for funding the planning activity. Then, the NIST funding dollars can be distributed to focused applied research in the areas that are indentified as crucial industry gaps, by the iNEMI roadmaps.

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

Each industrial member (with the exception of nonprofit research institutes) should be required to provide as a minimum in kind cost sharing. Keeping the "sharing" open to the in kind option (providing resources, or access to corporate lab or manufacturing lines/facilities) will allow small businesses that are very short on cash during the start up phase, to participate in the consortia teams. The nonprofit research groups on the other hand should receive the financial grants (without cost sharing by them) that are required to fund their own resources.

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

The proposals should have all key supply chain capabilities and participants identified that will ensure a successful end game of deployed industrial technologies. It should also evaluate the skills and management capabilities of the program leaders. And it should ensure that the research plans are aligned to the industry technology roadmap gaps and timelines.

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

The proven iNEMI methodology is a great example that should be used by the AMtech consortia. We require the identification of chair and co-chair names from the collaboration participants,

typically very senior technical leaders of motivated industry/academic players. And then we commit iNEMI project management resources to facilitate the development of clearly defined statements of work, the sign up of team participants, and ultimately the coordination of the key planning and execution sessions of the collaborative teams. Without this management system backbone and methodology that iNEMI employs, teams will be inefficient in the execution of the necessary R&D.

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

Absolutely, the key to success is excellent leadership from the team participants and a well proven management system.

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

iNEMI has found that collaborative projects need to have phased deliverables that are no greater than 12-18 months in length, per phase. There can be multiple phases (3 phases are very typical) that can thus make a total program be 3-5 years in length. But the requirement to hold teams accountable to phased deliverables ensures that the teams set realistic targets and measure themselves against those targets and that at the end of each phase the targets of the next phase can be refined based on the learning of the completed phase (s) .

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

Performance should be evaluated against the schedule and committed deliverables that are defined by the project teams. Performance against schedule, against predefined project experimentation, and quantified process performance metrics are appropriate. The specifics deliverables must be defined up front prior to project launch.

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?

Research by its very nature is exploring new and unproven technologies and capabilities. Thus the teams will learn and refine their goals as they proceed. The AMTech funding and review system must allow for this refinement system as research proceeds .

19. How should the NIST AMTech program be evaluated?

By the performance of funded projects to meet their predefined deliverables. Then, at a higher level the overall NIST AMTech program must be evaluated based on its delivery of competitive and deployed technologies and capabilities that lead to successful industrial businesses and job growth. The ability to leverage the iNEMI roadmaps and the proven iNEMI methodology plus the strength of our global membership will lead to higher probabilities of successfully deployed winning technologies.

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

Key lessons that iNEMI has learned are:

1. *The disciplines to define program deliverables, participant roles and responsibilities, and IP management prior to project launch is a must.*
2. *Providing trained and senior project management resources that keep the project teams on tract to schedules and deliverables is key.*
3. *Getting excellent leaders (chair and co-chair roles) identified and committed.*
4. *Having adequate funding*
5. *Having committed industrial partners and ensuring a total supply chain approach is executed will enable higher success rates in the deployment of developed capabilities.*

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

See iNEMI learning from answers above

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

Work with the focused federal funding agencies (such as NREL/DOE in alternative energy, EPA in the environment, NIH in medical, etc) to ensure they are aligned on the goals and deliverables of the AMTech funded consortia efforts. Those agencies are typically funding innovative research by individual organizations (not collaborative teams) and they should be keenly aware of the AMTech efforts to drive rapid deployment of winning technologies. The ability of AMTech to leverage the combined expertise of a good cross section of collaborative industry expertise could prove to be higher federal funding priorities that individual company efforts.

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

The iNEMI methodology and our focus in driving complex problem solving on the prioritized technology gaps in the areas of the environment, miniaturization, medical electronics, and alternative energy should be put to maximum use by AMTech. Then an open dialogue and update process should be established with those specific Federal funding leaders such as NREL, NIH, DOE and NSF. Reviews every 6 months would be appropriate.

Dated: July 19, 2011.
Patrick Gallagher,
Under Secretary of Commerce for Standards and Technology and Director.
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