

**Request for Information on Proposed New Program:
National Network for Manufacturing Innovation (NNMI)**

Submitted on behalf of the Pennsylvania State University Electro-Optics Center

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Technologies with Broad Impact

1. What criteria should be used to select technology focus area?

The criteria used to select any technology focus area should be consistent with the goals established in the National Science and Technology Council's plan **"A NATIONAL STRATEGIC PLAN FOR ADVANCED MANUFACTURING"**:

- Technologies which are critical to US Security whose systems and components are now being imported into the US.
- Technologies whose manufacturing capabilities have been relocated overseas.
- Technologies that have been subject to subsidies by foreign governments to create a competitive disadvantage to US manufacturing.
- Technologies that have the potential to impact a number of markets.
- Technologies that have strong support in local Academic Institutions.
- Technologies that promote employment.
- Technologies that promote domestic business expansion and new capabilities.
- Disruptive technologies that have the potential to replace existing processes.

2. What technology focus areas that meet these criteria would you be willing to co-invest in?

- Electro-optic materials, devices, systems and applications.

3. What measures could demonstrate that Institute technology activities assist U.S. manufacturing?

One of the key elements to demonstrating that the Institute is assisting U.S. manufacturing is to measure how many of the initiatives are implemented. To measure this each project selected to receive funding will need a technology transition path identified. That is, every project receiving funding should have a clear path that identifies the projects objectives and how, if successful, the project will be implemented in the manufacturing process. As a result, at the end of each initiative an assessment can be made to determine if it was transitioned. As a means of demonstrating success for this measure, a 60% Transition Rate should be set as the objective.

Other metrics could include increases in the work force for the Affiliate members on the Institute. (For the purposes of this discussion, Affiliates refers to all Businesses,

Academic Institutions, manufacturing related programs and networks and State and Local Economic Development Authorities that will work with the Institute.)

Another metric would be to track future cost savings. This could be accomplished through a transition plan that would require assertions of cost savings as the technologies are implemented from the customers.

4. What measures could assess the performance and impact the Institutes?

Depending on the specific initiative, there are a number of metrics that could be used to assess performance and impact of the Institute. In one instance, you could look at the return on the investment (ROI) of the initiative. That is, if the initiative called for a \$1,000,000 investment and at completion the project was transitioned with a return of \$10,000,000, you could report a 10:1 ROI. Other measures could include employment data, investment data, sales data and product data. That is, a measure of the Institutes impact would be changes in the employment numbers and the type of employees hired in the Affiliate Companies. In addition, measuring increases in corporate investment could demonstrate the success of the Institute. Finally Sales and product data could be measures of the Institutes success. In both cases, the data would address the question of have the actions fostered by the Institute enabled the Affiliate Companies to increase their sales, offer additional products or both? Another measure would be to track enrollment in the participating Academic Institutions relative to course work involving the core work of the Institute. Additionally, the Institutes cost of operation should be tracked as a method to reflect the Institutes ability to plan and control its costs. Finally, depending on the nature of the Institute, data could be collected to determine if Veterans are being hired to fill the positions.

Institute Structure and Governance

5. What business models would be effective for the Institutes to manage business decisions?

The Office Naval Research's ManTech Program offers an excellent model to manage business decisions. The model, which is focused on technology transition, calls for there to be an endorser (Sponsor) providing written commitment, for every project approved who would accept the project upon completion. This process insures that not only is there a need for the item identified at the onset but there is someone who is willing to utilize/implement the solution upon successful completion. In addition, as sustainment of the Institute is a major objective, a Return-on-Investment (ROI) model should be utilized to approve projects. Through the combination of these two approaches the Institute will be able to make sure that it is making both sound programmatic and business decisions.

6. What governance models would be effective for the Institutes to manage governance decisions?

An effective governance model for the Institute would be an "Advisory Board" model. Under this model the organization with which the contract is awarded would select a Director for the Institute. The Director would then call a meeting of the Affiliates and have them elect a representative Advisory Board to provide guidance and oversight to the Institute to insure that the Institute is accountable, transparent and compliant with all NNMI requirements. Representatives on the Advisory Board would serve on the board for a two year period. These Representatives serving on the Advisory Board would not be compensated but the costs of such could be considered as part of the cost-share provided to the Institute

7. What membership and participation structure would be effective for the Institutes, such as financial and intellectual property obligations, access and licensing?

Though not a direct response to this question, it is imperative that the Institute establish a core set of values which will serve as the framework for all membership and participation. These core values can, also, serve as a measure for determining the success of the Institute, i.e. how have the core values been embraced regarding the Institutes Investments, Workforce Development activities, etc.

Given the unique nature of each of the Institutes, it is hard to imagine that a monolithic model could fit all of the Institutes. That is, each Institute has its own set of issues that have brought it to the point where support is required and, as a result, there is no single model for success. As such, each Institute should be challenged to propose how it would address the issue as it relates to its particular challenge.

With that said, in order to expedite the contracting process it would be advisable that the Institute establish Master Ordering Agreements (MOA) with each of the Affiliates as soon as possible and that subsequent orders be placed as Task Orders (TO) under the terms of the MOA. In the MOA all issues, such as Financial; Intellectual Property; Access; Licensing and any other term that could potentially delay the start of an initiative can be resolved up-front as a condition of participation by all Affiliates.

The Institutes should incorporate some critical rules for intellectual property, access and licensing. First, each of these elements should serve as the foundation for Sustainment. Second, all intellectual property developed through Institute funding must be available to all Institute Affiliates. This could be done on a Royalty Free basis for members. Third, licensing must not be exclusive and the cost for utilization should be such to encourage broad application. Finally, all licensing funds should be rolled back into the Institute as part of its sustainment effort.

Affiliate membership in an Institute should be open to all parties who wish to become members so long as they are performing work related to the Institute's core objective. While membership contributions could be considered, it is important to note that a contribution could result in expectations that the contribution will result in a return. This unreasonable expectation could result in satisficing membership rather than seeking optimal solutions to Institute challenges. The only exception to membership in the field should be granted to an Institute that would plan on adopting a Technology Development Fund (see question 11. Below) and then Private Capital Companies could be allowed as a special class of membership.

8. How should a network of Institutes optimally operate?

The Institutes should meet periodically to discuss their success, failures and particular challenges so that the other Institutes can learn from the others experiences. In addition, there should be a monthly/quarterly newsletter from the NNMI focusing on the Institutes and assisting the Institutes advance their areas. Any overlaps in technology should be managed through a joint review of the projects. In addition, the

Institutes should look to the NNMI to assist them in creating an awareness of the work of the Institutes both in the Press and with the Government.

9. What measures could assess effectiveness of Network structure and governance?

The most critical elements towards measuring effectiveness of the Network structure and governance are growth and speed. In this case growth relates to the number of Affiliates that comprise the Institute. Speed relates to the process time for all aspects of the Institutes operations. This will include, but is not limited to, how fast it processes new membership applications; how long it takes to process a MOA; how long it takes to award a TO; and how timely are the Institutes contractual submittal. In addition, speed can be used to track how long it takes a project to have an impact on the Affiliate Company's manufacturing.

Strategies for Sustainable Institute Operations

10. How should initial funding co-investments of the Federal government and others be organized by types and proportions?

While each institute will probably embrace different models regarding how the funding will be provided, there are likely to be some common themes based upon the requirements that will be established in the Request for Proposal. That is, if Federal funding will not be made available for bricks and mortar, one could reasonably expect that significant initial co-investments, as well as ongoing costs associated with such from the recipient will be to support those activities. In addition, each of the Institutes will need to identify and hire staff to support the establishment and day-to-day operations of the Institute. Funding for this activity will likely be viewed as to come from the Federal Government.

One of the most critical elements in reviewing the requirements for initial funding is to establish reasonable expectations as to when funding would need to be available. That is, even adopting an existing model for how funds get disseminated to affiliates of the Institute, it will take time to establish the processes and procedures by which the funds are allocated to such. As a result, it is not likely that any major initiatives will be able to be awarded from 4 to 6 months after contract award and then it will take an additional 2 months before billing for those initiatives will begin to take place. The rationale behind this is simply that the documentation that will be needed between the various organizations to undertake the work associated with the Institute will require legal review and approval by the parties will take time. While the identification of projects can occur on a parallel path, the time associated with identification of potential projects; development of a Statement of Work and associated procurement documentation; development of a compliant proposal; the evaluation of the proposals and negotiations with the Awardee will take time. As a result, proposed funding models should be developed to provide a reasonable expectation that initial funding for Investments will likely not occur within the first 6 months after contract award. An additional item that should be considered is that the Institutes should carry a balanced portfolio relative to investments in projects. In this connotation “balanced” represents a solid mix of near, mid and long term projects.

11. What arrangements for co-investment proportions and types could help an Institute become self-sustaining?

A concept that could be considered would be to establish a Technology Development Fund using Federal and private funding for projects. If an Institute was able to develop a Technology Development Fund they may be able to attract private capital investment to match the public investment and, depending on the amount of money invested, create a self-sustaining fund within a three year span. The key to this approach would be to use proven business models for investments, i.e. ROI, and apply them to products and innovations that Small to Mid-Sized companies are struggling to bring to market. Return on the Investment would be shared by the Institute and the Private Investors in a manner which would provide funding for sustainment and a reasonable return for the private capital investor. The attraction to the private capital investor would be that the business model used to manage business decisions presented in the Institute Structure and Governance Section, would result in a higher success rate than a private capital investor would normally receive, thus the rationale for them accepting a lower rate of return than traditional funds. In addition, this would benefit the Small to Mid-Size companies because in this model the loans would not be subject to the normal requirements associated with a conventional Venture Capital program.

12. What measures could assess progress of an institute towards being self-sustaining?

In order to establish an enduring Institute it is imperative that the method by which the Institute achieves sustainment is identified as part of its proposal. One of the methods to demonstrate that would be the requirement for the proposer to provide a 6 to 10 year funding profile for the Institute. The funding profile should reflect the influx of the Federal Funding; Co-Investments; Dues and Membership Payments; Monies received from institute Sponsored Events, i.e. training and ROI. The Funding Profile provided in the proposal will serve as the basis for evaluating progress of the Institute toward achieving self-sustainment. As part of the data submittals after the contract award, the Institute should be required to report, on a monthly basis, its progress towards achieving the Funding Profile and any corrective actions that may be needed to reach self-sustainment. In addition to the written Monthly Reports, Formal Presentations should be a requirement to the NNMI on a 6 month basis. This approach has tangible benefits to both the Institute and the NNMI in that it requires the Institute to take the time to conduct a formal review of its activities as it relates to its long term objectives and allows the NNMI to see a complete overview of the Institute and how it sees its successes and challenges.

13. What actions or conditions could improve how Institute operations support domestic manufacturing facilities while maintaining consistency with our international obligations?

One of the ways the Institutes, and more particularly, the NNMI, could support domestic manufacturing facilities is through educating the public about the importance of US Manufacturing and how the citizens can support it. In turn, if the citizens expressed their support by letting retailers know their preference for domestic products, the retailers, in turn may start providing more. This, in turn would lead to increased US production, sales and employment. In this way, domestic manufacturing could increase without violating any international agreements.

The NNMI could, also, undertake the cause of promoting investment in US manufacturing by advocating changes to tax and investment policies.

14. How should Institutes engage other manufacturing related programs and networks?

There are a number of ways in which an institute can, and should, effectively and efficiently engage other manufacturing related programs and networks. Key members of the Institute should become members of local and national manufacturing related programs and networks.

The Institute should promote the work it is sponsoring by seeking to have the results published in Journals and presented at appropriate Technical Meetings. In addition, serving on Regional Business Roundtables will enable the Institutes to not only get the word out about the Institute but enable it to learn of what is going on elsewhere in the manufacturing community. While the above is not an exhaustive list, it represents a cost effective and efficient approach.

One of the challenges for an Institute will be the ability of it to balance its need to have an awareness of the emerging technologies from not the existing manufacturing network but also the efforts being pursued by scientific organizations and within government agencies. As a result, one of the measures for the success of an Institute could be the interactions that the Institute has with non-Institute Organizations.

15. How should Institutes interact with state and local economic development authorities?

Depending on the structure of the Institute, the Institutes should make an effort to include State and local economic development organizations as part of the Team in their initial proposal. By engaging them early in the process not only could they assist in contributing to the identification of co-investments, but they could serve as a bridge between the Institute, local manufacturers, local government and the public. The ability of these organizations to get the word out about activities in the local area cannot be underscored and will be vital to sustaining the Institute after Federal Funding is no longer available.

16. What measure could assess Institute contributions to long term national security and competitiveness?

A successful Institute could contribute to long term national security and, at the same time, sacrifice competitiveness. That is, the success of an institute to develop or restore US competitiveness in a given market for long term national security, could in fact reduce competition. That being said, measures that demonstrated changes in the amount of goods that have been imported in a given period could serve to demonstrate that we have increased our national security by reducing the dependence on foreign sourced goods. A further measure of this would be to track if we begin to export those goods which were formerly imported. This would demonstrate that not only were we able to increase our dependence on imports but that we were now competitive. Another measure would be to track the price of the item from the time the Institute was established to the current price. This would serve as another measure of our competitiveness.

Another method that could be developed and implemented would be a stress test of the industry as a whole. That is, models could be developed to determine if the industry could survive in the impact of currency fluctuations, labor rate changes, demand changes and policy changes. Based on the results of the models, the Institute could initiate some changes to its investment portfolio to support the ability of the manufacturers to pass such a stress test.

Education and Workforce Development

17. How could the Institutes support advanced manufacturing workforce development at all education levels?

In order to be successful, the Institutes will need to take a number of different methods to engage all levels of education. For the purpose of this response, the following categories are provided:

- Incumbent Workforce;
- Transitional Employees;
- College Students;
- K-12

The Incumbent Workforce is defined as employees actively engaged in one of the Affiliated Companies. To address the needs of the Incumbent Workforce, taking into account that the hours they are available are limited, an effort should be made to have training available to them On-Demand. As such, Webinars and On-Line training should be made available. In addition, Seminars and Workshops should be offered for those that can attend. Finally, a Speaker Series could be made available from some of the participating Academic Institutions.

Transitional Employees are defined as potential employees that are seeking entry into the field. To support these potential employees, the Institute should work with local Community Colleges to develop curriculum that will provide them with entry into the field.

In order to address the needs of College Students, the Institute should work with its academic affiliates to make sure that they are offering courses that will allow College Students entry into the field upon graduation. In addition, the Institute should work with its Industry and Academic affiliates to develop a comprehensive Internship Program that will enable College Students the opportunity to work at the Industry Affiliates while in College.

Addressing the needs of students enrolled in grades K-12 will take on a variety of methods. First, the Institute should work with the local school districts to see if they will incorporate some of the disciplines into their standard curriculum. If the school districts are willing, the Institute could develop a "Train-the-Trainer" Program and invite local school teachers to participate so that they may incorporate the data into their classroom. In addition, the Institute should work with Academia partners to develop multi-discipline teaching modules to introduce the subject matter. Second, the

Institute, working with the local Industry Affiliates should sponsor and provide Summer Camps for local students related to the Institutes activities. Third, the Institute and Business affiliates should sponsor local group participation in clubs and competitions related to the Institute.

18. How could Institutes ensure that advanced manufacturing workforce development activities address industry needs?

The Institute's Advisory Board should establish a Sub-Committee dedicated to working with Industry Affiliates to focus on determining the needs of industry. That is, identify what disciplines are needed to meet the near, mid and long-range needs of the Institutes membership. The Sub-committee should report its finding to the full board and to the Academia partners to determine how best to address the needs.

19. How could Institutes and NNMI leverage complement other education and workforce development programs?

Institutes and the NNMI could complement each other through sharing best practices and lessons learned. The various Institutes working with the other Institutes to determine how they have been able to incorporate workforce development activities through all education levels will only serve to benefit each.

20. What measures could assess Institute performance and impact on education and workforce development?

Assessing the Institutes performance and impact on education and workforce development is a particularly daunting issue. That is, metrics can easily be established to quantify the performance of the Institute, i.e. how many engagements has the Institute had; how many outreach activities has it conducted; how many students has it trained, etc. However, measuring the impact of those activities is an entirely different matter. While it may be possible to quantify the impact that a particular class has had on a worker, increased production, increased yield, etc., quantifying how a workshop which serves to "introduce manufacturing" to a middle school student impacts their abilities is rather hard to quantify. Often the impact of these events will take years before any impact could be measured and, quite arguably, impossible to draw a proper inference after such an extended period.

21. How might institutes integrate R&D activities and education to best prepare the current and future workforce?

All R&D activities sponsored by the Institute should be coordinated with its Affiliate Company and Academic members. In that way, the Institute can be assured that the results of its R&D initiatives will be implemented by its Affiliate Companies and supported by its Academic Affiliates. This, in turn, will allow the Academic Affiliates to be able to develop curriculum to support the results of the R&D initiatives for both the current and future workforce.