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To: nnmi\_comments <nnmi\_comments@nist.gov>  
Cc:  
Date: Fri, 24 Aug 2012 15:35:21 -0400  
Subject: NNMI Comments

Greetings,

I attended the Workshop held on July 9 at Cuyahoga Community College and had an opportunity to gain a much better understanding of the goals and proposed structure of the NNMI. Having participated in the discussions that day and after having some additional time to consider elements of the proposed program I would like to provide the following comments.

1. My company, NanoInk, Inc., was founded over 10 years ago as a startup out of Northwestern University. Our business goal was to commercialize a nanofabrication technology, Dip-Pen Nanolithography, that was developed at Northwestern. I believe our experience is representative of many instances where the time, effort, risk and cost to develop a technology from basic research results to commercial operation would deter investment by traditional VCs and existing firms. It's taken almost 10 years and over \$100M to transform the initial research findings into a viable production technology. It is unlikely that our company and our unique and disruptive nanolithography technology would have reached their current stage without the exceptional and long term support we've received from our main investor. We are very much an exception in this case and this is why a program like the NNMI would be of such great value to help develop and maintain new advanced manufacturing technology in the United States. In our case, we are developing a platform nanomanufacturing technology with broad application. Although we've achieved a measure of success to date, we've been able to fund only a small fraction of the work required to fully exploit this technology across the spectrum of potential applications. So either for a new startup or a more developed company, without outside support and access to markets/customers many advanced manufacturing technologies will languish, fail or end up as attractive buy out targets for foreign interests.

2. I don't want to sound overly political or negative about use of government funds to support commercialization of technology but given the enormous amount of funding provided to agencies and organization such as the NNI, NIH and NSF or directly to companies, our track record of creating economic value and jobs is poor. In the case of basic research funding there is not enough emphasis, performance metrics and/or expectations of success in regards to commercialization. The NNMI must adopt an approach that is very objective in terms of goals and metrics. The links to and direction from private industry are most critical since these are the ultimate customers. Private industry must ultimately support the Institutes and commercialize the advanced manufacturing technology if we are to realize returns on this investment. I think the CNSE Albany Nanotech Complex is an excellent example where industry, universities and the local community have collaborated to create a world class facility that is both advancing

research and creating jobs. The strong support and direction from industry is key to their success.

3. I see two, somewhat distinct, opportunities for the NNMI to fulfill its mission of refining and applying emerging technologies for advanced manufacturing. Based on my observations and experience over several startup companies I've seen two points where companies attempting to commercialize new technology fail. First, new technology transferred from university research needs to be developed to a point where proof-of-concept is demonstrated or an operational prototype developed. At this point you've established the viability of the technology (or not) and the results can be used to secure funding, attract corporate partners and/or allow a self-sustainable company to be spun-out. The target here is new company formation and the job creation and economic value created by high technology small businesses. The Institutes can provide an infrastructure and resources to support these early stage efforts along with connection to potential corporate partners. In this case the Institute is acting somewhat like an incubator to enable new company formation. The second stage where companies face challenges is manufacturing scale-up including all the development required to meet the cost, quality and throughput requirements for commercial production. Here again is where I see an opportunity for the Institutes to provide support to facilitate this transition and reduce the risk of adoption by established firms. The target would be broadly applicable manufacturing technologies that could be transferred or licensed to multiple industry partners.

4. I recommend the following technology focus areas based on their broad potential impact and current state of development within the U.S.:

- a. Nanomanufacturing (possibly more than one focus area, advanced lithography for semiconductor industry is already well covered by Albany program)
- b. Printed electronics (displays, LEDs, PV, sensors)
- c. Sensors (MEMS/NEMS/MOEMS)
- d. Sustainable manufacturing/Green chemistry
- e. Bioprocessing/Synthetic biology
- f. Nanomedicine/Nanomaterials for Life Sciences
- g. Nanomaterials (electrical/mechanical)
- h. Micromanufacturing (micromachining, molding, laser)
- i. Robotics

5. Finally, I think the emphasis on workforce development is essential. I think each Institute, given their specific focus, may have unique workforce development needs but I also believe

there are some general goals that will be shared across the network. One general area for emphasis is STEM education at the K-12 levels and the Institutes should support existing or develop new programs within their local communities. Programs to both enhance STEM educational outcomes and attract young people to science and technology based careers are needed. The Institutes in collaboration with local universities can provide excellent coop/intern programs for students and also in-residence programs for educators. Although there will continue to be a need for people with advanced degrees, many of the new advanced manufacturing jobs created can be filled by educational programs to train or re-train people using the existing community college system. Here in particular is an opportunity for the Institutes to work with the community colleges to develop programs tailored to the anticipated workforce needs resulting from their focused programs.

Thanks for the opportunity to provide input to your planning process. I would be happy to further discuss my comments or help support this initiative as it moves forward.

Regards,

Mike

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