



March 7, 2018

Mr. Ted Wackler
Deputy Chief of Staff and Assistant Director
Office of Science and Technology Policy (OSTP)
Eisenhower Executive Office Building
1650 Pennsylvania Avenue
Washington, DC 20504

RE: RFI Response: National Strategic Plan for Advanced Manufacturing

Dear Mr. Wackler:

Thank you for the opportunity to provide input to the Office of Science and Technology Policy (OSTP) and the National Science and Technology Council (NSTC) as you work to develop a National Strategic Plan for Advanced Manufacturing.

Together our two associations represent most of the major public and private research universities in the United States. Our member institutions conduct a significant amount of research on behalf of the U.S. government to support our national security and economic objectives, including research that directly supports advanced manufacturing. These universities also educate and train students for our nation's future manufacturing workforce and, along with the U.S. manufacturing sector, are keenly interested in ensuring students gain the requisite skills while studying at their institutions. We therefore offer the following comments in response to the recent OSTP/NSTC request for information:

Question 1: *In priority order, what should be the near-term and long-term objectives for advanced manufacturing, including R&D objectives, the anticipated time frame for achieving the objectives, and the metrics for use in assessing progress toward the objectives?*

As the OSTP and NSTC develops the Strategic Plan for Advanced Manufacturing, we ask that the plan includes investment in a balanced portfolio of long-, medium-, and near-term advanced manufacturing research efforts and higher education programs. Longer-term research investments made by the federal government should focus on fundamental and transformative research topics essential to the future success of U.S. manufacturing. Individual manufacturing firms are unwilling to make their own investments in such fundamental and transformative research because they cannot guarantee that these investments will yield any immediate returns directly to their company. Near-term advanced manufacturing research programs and investments are also required to leverage and take advantage of longer-term investments, and should emphasize incentives for universities and industry to work together in regional consortia and partnerships and to commercialize and scale advanced manufacturing technologies. These consortia should also be used as a training ground for future manufacturing leaders.

In addition to R&D investments, it is critical that the government help to support and foster education and training programs that further strengthen the longstanding partnership between higher education

and the manufacturing sector, which has proven invaluable to our nation's economy and global competitiveness. These programs should aim to provide industry-relevant, manufacturing-focused skills to both the current and future manufacturing workforce, and should be aimed at developing design and engineering talent as well as technical and production workers. Education and workforce strategies should take advantage of and leverage the existing network of higher education institutions and research universities that has served the nation well and which is the envy of the world. This includes the wealth of expertise the resides in our university engineering colleges and business schools, both of which can be of great benefit to advancing U.S. manufacturing education and workforce efforts.

Question 2: How can Federal agencies and federally funded R&D centers supporting advanced manufacturing R&D foster the transfer of R&D results into new manufacturing technologies and United States-based manufacturing of new products and processes for the benefit of society to ensure national, energy, and economic security? What role can public-private partnerships play, and how should they be structured for maximum impact?

The U.S. higher education sector is central to one of the longest standing public-private partnerships, not only at the federal level, but also at state and local levels. The Morrill Act of 1862 – often referred to as the Land Grant Act – provided federal lands to the states with the express purpose of creating a comprehensive set of state-based universities with particular emphasis on agriculture and the mechanical arts (engineering). The land-grant university system was established to invest in education and research with expected impact on economic sectors such as manufacturing. Additionally, this government-university partnership was strengthened after World War II, when the federal government made a conscious decision to award competitive research grants and contracts to both public and private universities to support the work of federal mission-based agencies aimed at upholding the country's national defense, health and economic goals.

The motivations driving the federal government to have universities conduct research in these areas was two-fold. First, such a partnership was viewed as a way to ensure that an underpinning, fundamental knowledge base would be generated to support U.S. national defense, economic security and industrial interests. It was determined that the government should rightfully invest in research that would not specifically benefit any one firm, but rather would help to advance key industrial sectors such as agriculture and manufacturing. Such investments would be made in longer term research challenges, for which the benefits could not be assumed to be secured by any one single company or manufacturer. Second, at the same time our universities were conducting the research, top scientists at the universities were training students, some who would go on to sustain the U.S. academic research and education enterprise while others would become key leaders within industry and in government.

We encourage the administration to use the new National Strategic Plan for Advanced Manufacturing to improve and further leverage the already existing government-university partnership to the benefit of manufacturing, as well as establish new government-university-industry partnerships. To this end, we would urge continued support for the existing network of manufacturing innovation institutes coordinated by Manufacturing USA. These institutes have been successful in forging meaningful partnerships between universities and industry and have been very helpful in advancing the deployment of R&D results.

With regard to specific strategies related to university-industry collaboration and technology commercialization, of note is a study currently underway and funded by NIST. A NIST grant to the University of Michigan is supporting a study of APLU's Innovation and Economic Prosperity (*IEP*)

Universities Program with the aim of identifying practices and partnerships that have proven effective in transfer of R&D from public universities to private technology developers. The results of this NIST study may well provide additional insights that could be helpful to OSTP and NSTC in advancing the objectives of this strategic plan.

Question 3: *What innovative tools, platforms, technologies are needed for advances in manufacturing? Of those that already exist, what are the barriers to their adoption?*

U.S. universities offer a wide range of existing research tools, educational platforms and advanced technologies that can help facilitate and support U.S. advanced manufacturing training and research.

Increasingly, our universities have expanded our ability to provide for distance and on-line learning opportunities. At the same time, we have been transforming the way we teach to focus on more project-based, dynamic and interactive teaching environments that better equip and train students in STEM disciplines and manufacturing related skills. We have developed new experiential learning opportunities and makerspaces at our universities, which promote creativity, innovation and entrepreneurial thinking and which challenge our students to address real world problems. Examples include Case Western Reserve University's "[think\[box\]](#)" which utilizes 3-D printing, scanners and computer-aided design software and the University of Texas at Austin's [Longhorn Maker Studios](#).

Universities also offer opportunities for the development of shared and collaborative research facilities where industry and academic partners can work together. Examples include The Ohio State University's [Center for Design and Manufacturing Excellence](#) and the [Clemson University International Center for Automotive Research \(CU-ICAR\)](#). Additionally, new advanced manufacturing facilities such as those recently opened at the [University of Massachusetts Amherst Institute for Applied Life Sciences \(IALS\)](#), are being developed and will help leverage state and local funding to provide space and opportunities for small and medium-sized businesses to access state-of-the-art equipment and areas where they can work to develop proof-of-concept prototypes.

Question 4: *How can such Federal agencies and centers develop and strengthen all levels of manufacturing education and training programs to ensure an adequate, well-trained U.S. workforce for the new advanced manufacturing jobs of the future?*

To continue to improve and enhance manufacturing education and training, we believe that federal agencies must continue to find ways to support and foster public-private partnerships. Such partnerships continue to be essential, particularly as “work-and-learn” strategies (e.g., internships, co-ops, problem-based learning, apprenticeships) grow in their importance to ensuring a workforce capable of dealing with rapidly emerging technologies.

APLU is currently working with the Lightweight Innovations for Tomorrow (LIFT) manufacturing institute in Detroit to help deliver on the promise of this public-private partnership. Through its technology projects, LIFT is bringing industry together with academe to conduct R&D on vital new light-weighting technologies. Too often, new technologies are developed and deployed before we begin planning for the workforce required to ensure successful technology outcomes. In the APLU partnership with LIFT, which also engaged the National Center for Manufacturing Sciences (NCMS), technologists are coming together with an “Expert Educator Team (EET),” members of which are also materials engineers and scientists, to determine at an early stage—while the technologies are still being developed—what the necessary competencies will be for both design/engineering and also technical/production workers. The

EET is also making recommendations about strategies that colleges, universities, and other education and workforce providers can undertake to develop talent with these needed competencies. We believe that the LIFT-APLU-NCMS effort can serve as a model for other Manufacturing USA institutes.

Question 5: *How can such Federal agencies and centers assist small and medium-sized manufacturers in developing and implementing new products and processes?*

As the government seeks to assist small and medium-sized manufacturers in developing and implementing new products and processes, it should seek to re-invest in and fully leverage the existing university-based research and education system. Universities have longstanding positive impacts on the formation and growth of small businesses (and the growth and advancement of those small businesses into larger companies). For example, a 2015 study released by the Massachusetts Institute of Technology (MIT) indicated the companies founded by MIT's alumni entrepreneurs have created millions of jobs and generate annual revenues of nearly \$2 trillion — a figure greater than the gross domestic product (GDP) of the world's 10th-largest economy. Moreover, universities have been investing their own funds to help develop and foster new manufacturing ventures and start-up companies.

Additionally, we believe that the success of the Manufacturing Extension Partnership (MEP) needs to be recognized. The unique public-private partnership has been a tremendously successful vehicle to help the federal government in its effort to support small and medium-sized manufacturers. The existing 51 MEP centers, located in all 50 States and Puerto Rico, have worked with these manufacturers to improve their workforce capabilities, increase their productivity and reduce costs, develop and launch new products, and to help them to access resources they need to succeed. The MEP centers, which are often based at or closely aligned with major research universities, represent the very type of program that we should be working to promote and encourage as we work to improve and enhance U.S. advanced manufacturing capabilities.

Conclusion

Our member universities are strongly committed to helping develop and implement a comprehensive national strategy for advanced manufacturing. The institutions we represent have a strong track record of engagement with the manufacturing sector.

Our associations and member universities look forward to working with you in continuing to advance and support manufacturing and a robust U.S. economy well into the 21st century. Please contact us with any questions.

Sincerely,



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