



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
National Science and Technology Council, Committee on Technology
Subcommittee on Advanced Manufacturing
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Dear Mr. Wackler:

The American Society of Mechanical Engineers (ASME) and the undersigned organizations ardently support a National Strategic Plan for Advanced Manufacturing with a long-range outlook for increased coordination and sustained support for Federal programs and activities. The U.S. manufacturing base is significantly impacted by fluctuations in national strategy and R&D investment and cannot maintain growth or innovate without a coordinated long-range plan that is competitive with other nations. In developing a National Strategic Plan for Advanced Manufacturing, it is imperative that the United States think long-term and address the current instabilities impeding sustained success in the advanced manufacturing sector. Below are suggested near-term and long-term objectives that interconnect and, if considered and adopted in unison, will work together to ensure far-reaching American prosperity in advanced manufacturing.

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?*

Short-term successes in manufacturing are dependent on long-term planning. In the near-term, the Federal Government must show it has an unwavering commitment to the advanced manufacturing sector so that industry and other stakeholders can invest without fear that the Federal Government will eliminate or pull back from programs it has invested in. Industry needs the assurance that the Federal Government is its partner, together working on pre-competitive, pre-market solutions to national manufacturing concerns.

The Federal Government's tendency to offer initial investments to spur immediate growth with the expectation that the technology will be commercially viable in five years relies on industry to pick up the torch. While U.S. industry can commercialize certain aspects of advanced manufacturing technologies quickly, many of the advanced technologies themselves are still new and rapidly changing and have the potential to create additional opportunities not thought of in the short term. To accelerate these advances, the Federal Government plays an important role as a neutral convener, bringing together

industry, academia, and the public sector to work cooperatively towards mission-driven solutions in a pre-competitive environment.

For the Federal Government to successfully fulfill this role, there needs to be support for longer-range research targeting 10-15 years out, and there is a need to ensure that this longer-range research is being funneled into medium- to short-range research and development so that we can make use of and leverage this work. In supporting a thriving manufacturing innovation pipeline, the United States will be able to innovate at a pace competitive with other nations, ensuring the next breakthrough manufacturing technologies are invented and commercialized here in America. To this end, in addition to initial research funding, the Federal Government must play an ongoing role as a neutral convener and accelerator of technology by offering sustained funding for important manufacturing programs and commit to scaling these programs to a level that will ensure the United States' sustained leadership in advanced manufacturing.

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?*

Feeding the innovation pipeline is crucial to fostering the continuous transfer of R&D results into new manufacturing technologies. Providing global leadership in advancing fundamental research has been an ability unique to the U.S. for decades, but other countries have begun to take a page out of the successful American playbook. To remain the world leader in fundamental engineering research that feeds the manufacturing innovation pipeline, there needs to be a moon-shot approach to funding more research. Any National Strategic Plan for Advanced Manufacturing that does not include support for fundamental research will be short-sighted and lead us on a path to technological stagnation. It takes many years, if not decades, for research to mature into viable commercialized technologies. The advanced manufacturing innovations of tomorrow are entirely dependent on today's research, and research is also entirely dependent upon the ability to budget for the long term.

A healthy domestic manufacturing ecosystem begins with investing in basic manufacturing research and continued support for transitioning promising research through higher Technology Readiness Levels (TRLs). It is vital that the U.S. Federal Government invest at every step of the research pipeline first in early-stage research where it is too risky for industry to invest and then to catalyze private investment for later-stage research and development before the technologies are ready for industrial commercialization. This commitment allows us to monitor key areas of emerging technology that have the potential to become the next big manufacturing disruption—such as additive manufacturing or the Industrial Internet of Things—and ensures we are effectively scaling this technology. Otherwise, we risk developing the technology and handing it off to our competitors for commercialization.

Public-Private Partnerships play an important role in ensuring advanced manufacturing benefits the national interests. Without proper Public-Private Partnerships, the timeframe for innovations to reach commercialization will significantly lengthen, impacting our military capabilities and global leadership prowess. If the government does not fully commit to its role as a neutral convener through existing and new Public-Private Partnerships, multiple players in the same industry will have no incentive to work together on pre-competitive research and development, stunting the growth of the U.S. advanced manufacturing sector and compromising our role as the world leader in innovative technologies.

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?*

The lack of a formalized technology transition process is a major barrier to adoption of new and innovative tools and technologies. Formalizing and strengthening existing processes to connect early-stage researchers with later-stage developers will fuel the transition of fundamental research from agencies like the National Science Foundation (NSF) to programs that will advance and mature the technologies so they are ready for American industry to transition into viable commercial products. The U.S. Federal Government's investment at each stage of the research pipeline is vital for rapid technological advancements, and a coordinated, strategic effort to transition technology from one stage to the next will result in a more rapid return on investment for the U.S. both in terms of economic growth and in strengthening our industrial base.

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?*

A strong national strategy for advanced manufacturing must support universities working with community colleges and industry to develop next-generation advanced manufacturing curricula. Additionally, manufacturing education involves laboratories which are expensive to operate. Investments are needed in curriculum development as well as state-of-the-art equipment and facilities to enable universities and community colleges to offer much needed education and training.

Internationally, the United States is considered strong in research and weak in development. This is reflected in current engineering curricula that, by and large, lack coursework preparing students for the manufacturing industry. While current U.S. engineering students are strong in fundamentals, they lack an understanding of how technology transitions to the market. Efforts are needed to help students understand what controls the cost of products and how to design manufacturing processes to produce products at costs that support sustained manufacturing.

Some U.S. manufacturing companies have begun to “on shore” the manufacturing of products, which will increase demand for manufacturing engineers with a heightened understanding of automation and industrial robotics. Unfortunately, efforts to teach such advanced manufacturing courses to engineers at universities face resistance. Manufacturing education is perceived by many as technical in nature, or an application, not a fundamental part of an engineering education. However, manufacturing is the end process for most engineering activities. Our students need a better understanding of today's manufacturing environment and challenges to be able to design and engineer products that take full advantage of the new possibilities that advanced manufacturing offers, while understanding their limits as well.

The word “manufacturing” often conjures up images of outdated practices and factories that were the powerhouse of America during World War II. This association does a disservice to the exciting world of manufacturing today where industrial robots and human-machine interfaces make manufacturing a career of the future, not the past. When students and potential employees set foot in an advanced manufacturing facility for the first time, their thinking is transformed. They see an opportunity to do something that has never been done before and to be on the frontlines of the next industrial revolution. If this understanding of what manufacturing looks like today is better understood by students, parents, teachers, and counselors we would see a dramatic shift in the number of students working towards a career in this rapidly advancing field. Advanced manufacturing offers opportunities at every level—from

the technician to the engineer. Efforts to get students engaged in manufacturing competitions, scholarships, and industry internships are greatly needed in secondary education to recruit the next generation of students into manufacturing career paths.

Under the current labor environment, it is exceptionally difficult to train our youngest generation on new manufacturing practices. High school students—and perhaps even junior high students—would benefit educationally from being granted access to labs, training facilities, and factories. Through summer apprenticeships and after school jobs, these students would have the opportunity to gain the hands-on experience they need to be hired directly out of high school or the skills necessary to pursue further education at a community college or four-year university. Furthermore, programs should be expanded so that high school teachers and counselors have the opportunity to experience what it is like to work in an advanced manufacturing facility as a second or part time job, or even over the summer, so that they are better able to communicate the opportunities a career in advanced manufacturing provides.

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

Diffusing new and emerging technologies into our Small and Medium Enterprises (SMEs) will ensure our industrial base remains competitive. Data from the Census Bureau show that companies with fewer than 500 employees account for 99 percent of U.S. companies engaged in manufacturing. Furthermore, companies with fewer than 20 employees account for almost 75 percent of all manufacturers. SMEs make up a significant portion of the U.S. manufacturing enterprise, but because of their limited resources, SMEs often struggle to keep pace with emerging technologies and best practices. It is important that the Federal Government works with SMEs to ensure they have access to advanced and emerging technologies so that domestic manufacturers can remain technologically competitive and the U.S. can remain globally competitive.

Question 6: *How would you assess the state of the following factors and how they impact innovation and competitiveness for United States advanced manufacturing?*

Part B: *The adequacy of the national security industrial base.*

Advanced manufacturing is an integral part of the defense industrial base and is the foundation on which we secure our nation during times of conflict. The U.S. Federal Government realizes the importance of a strong domestic manufacturing base and must offer sustained, robust investments to bring our antiquated manufacturing practices into the 21st century and beyond. In areas such as the military, where the government is the main consumer of technological innovations, the market will not guide the industry to invest in research and development for mission-critical systems, processes, and tools. For the military to be adequately prepared for future conflicts it needs to invest in developing technologies well before they are needed. A strong domestic manufacturing not only ensures we are ready to manufacture and deploy the technologies when they are most needed, but also allows the United States to invent new technologies that an outdated manufacturing base would not be capable of making. Additionally, in investing early in research and development that has potential national security benefits, the United States will see a huge return on investment in terms of cost savings and efficiency when making future procurements.

Part C: *The capabilities of the domestic manufacturing workforce.*

With the evolution of the digital manufacturing enterprise and Industrial Internet of Things, machines are becoming smarter and more connected, and humans more disassociated, leading to worker apathy and loss of empowerment. A renewed focus on the interaction between new manufacturing technologies and the human element that interfaces with them is needed. Emerging topics such as Industry 5.0 (commonly portrayed as “Manufacturing with a Human Touch”), Biological Manufacturing and similar paradigms point to the need to better integrate humans with technology. Investment in this integration will yield a more engaged and informed workforce with commensurate improvements in output, as well as spur new scientific discovery at the intersection of the technological and social sciences.

Question 7: *Is there any additional information related to advanced manufacturing in the United States, not requested above, that you believe OSTP should consider?*

A long-term, coordinated strategic plan encompassing the above elements would set the United States advanced manufacturing sector on a strong, sustainable path that would lead to more high-wage jobs. However, a National Strategic Plan is only effective if it is properly implemented, which is why we support the naming of a Chief Manufacturing Officer to coordinate manufacturing activities government-wide. A Chief Manufacturing Officer would be responsible for coordinating manufacturing-related policies and activities across agencies to eliminate any duplicative efforts and streamline processes to make sure all Federal efforts are as efficient as possible in achieving their mission of increasing manufacturing competitiveness, creating new jobs, growing the economy across multiple industrial sectors, strengthening national security, and improving healthcare.

We look forward to working with you to strengthen the U.S. manufacturing sector. Please contact Samantha Fijacko at fijackos@asme.org if you have any questions.

Sincerely,



Charla K. Wise
President
ASME

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