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"Make It in America: What's Next?" District Field Hearing PANEL ONE: Maryland Research and Innovation

1. The ability to innovate will increasingly depend on the presence of a vibrant manufacturing ecosystem.

In today's global economy, the ability to innovate is crucial to creating new business opportunities and maintaining a healthy economy. The presence of a local manufacturing ecosystem is needed to maintain the US leadership in innovation and creating new industries. Designers need to understand how the manufacturing processes work to realize innovative products that are affordable and compete well globally. This understanding is difficult to achieve if the designers unable to closely interact with manufacturing engineers and experience manufacturing first hand. In today's fast-paced world, designers need rapid access to manufacturing processes to try many different concepts to select the winner. Often the understanding of innovations in manufacturing processes can also lead to innovations in products. A nation cannot simply hope to continue to be at the forefront of innovations without having a healthy manufacturing infrastructure. There are many nations that are aggressively competing with the US in the innovation arena. The US has done remarkably well in leading the world in providing ground-breaking innovations. Many of these innovations came from companies located in Maryland. But the past performance alone cannot ensure continued future success. The US should make every effort to ensure that it maintains a healthy manufacturing sector.

2. A healthy manufacturing sector provides well-paying jobs and is crucial to the national security.

In addition to enabling innovation, a healthy manufacturing sector is necessary to provide well-paying jobs and maintaining favorable employment numbers. High-value manufacturing also creates export opportunities and helps with the trade balance. A healthy manufacturing sector is also needed to ensure national security. We should never be in a position to import parts that are critical to national security. In today's era of constant cyber threats, we do not want to become vulnerable by importing parts that might have intentionally placed malware or serious security loopholes. Not doing so will simply give an opportunity to our adversaries to neutralize our technological superiority.

3. Recent advances in manufacturing are creating new opportunities for the US in high-value manufacturing.

The field of manufacturing is currently undergoing major changes. 3D printing is expected to revolutionize manufacturing. It enables designers to realize complex designs rapidly. The cost of 3D printers is dropping dramatically. This means that people who did not have access to manufacturing until now can buy 3D printers and make things themselves. Recent advances in robotics are reducing the need for manual labor and hence making manufacturing economically viable in high-wage rate regions. The Internet of Things technology is expected to lead to smart manufacturing. Companies need to offer high quality products of increasing complexity at a faster pace with lower prices. This makes manufacturing very challenging. Smart manufacturing technologies are expected to significantly improve manufacturing efficiency and productivity. These technologies can also be used to reduce negative environmental impact of manufacturing. Recent advances in materials such as digital materials, multifunctional materials, metamaterials, and programmable

materials are expected to enable a new generation of products. Almost all of these advances originated in the US. We should leverage these advanced manufacturing technologies to grow manufacturing industry in the US and Maryland.

4. Advanced manufacturing will require a workforce with strong STEM background.

Advanced manufacturing requires a different kind of workforce. Rather than relying on manual skills, people are expected to work with sophisticated machines. The nature of the products is also expected to change rapidly. This requires a very different kind of workforce. Training the workforce for the next generation manufacturing technologies will require a strong emphasis on STEM subjects and a new pedagogical approach. Schools, colleges, and universities will need new labs with access to advanced manufacturing technologies. A closer partnership with industry will also be needed to ensure that the workforce training programs match the skills required by the industry. The University of Maryland is developing new labs and courses in the Advanced Manufacturing area to support Maryland-based businesses.

5. Recent technological advances are expected to create new business opportunities.

New markets and industries will be created around several emerging areas such as unmanned systems, driverless cars, electric vehicles, next generation batteries, intelligent prosthetic devices, smart appliances, and personalized medicine. Many of these technologies were developed in the US. The US should strive to become the leading world manufacturer and exporter of products in these emerging areas. The state of Maryland should lead the nation by demonstrating how to leverage recent innovations to launch new manufacturing-based businesses.