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Opening Statement
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University of Mississippi November 5, 2019

Mr. Chairman and members of the subcommittee, let me first thank you for the opportunity to provide my perspective on the role universities can and should play in the development of the nation's STEM workforce to provide NASA with the engineers and scientists needed to keep accomplishing its mission into the next generation.

My name is Josh Gladden and I have the privilege of serving as the Vice Chancellor for Research and Sponsored Programs and Professor of Physics at the University of Mississippi. Before this role, I served as the Director for the National Center for Physical Acoustics and Group Lead for the Materials Physics Lab at the NCPA.

As with many technical objectives and challenges we will face in the next generation, the complexity of the missions at NASA will only increase. It is incumbent on higher education to prepare a workforce ready to meet these challenges.

One critical element in preparing this unique workforce is the necessity that they are ingrained with a predilection and passion for life-long learning. Transformative technologies are no longer coming once in a generation – they are coming every decade. We have several programs and initiatives at the University of Mississippi to address these educational challenges.

We have designed and are in the process of building a unique 200,000 square foot STEM education facility. What makes this space unique is that it is designed from the ground up around collaboration across disciplines and active-learning teaching methods that focus on small-group project work and interactive technologies. These instruction methods have been shown to both improve comprehension of science and engineering principles and promote group problem-solving skills.

Another unique program at UM is our Center for Manufacturing Excellence. All CME students major in engineering, business or accounting, but also share coursework across each of the three disciplines. CME students focus on group projects, communications skills and understanding a holistic view of a particular problem – from technical to financial aspects. We cannot predict the technologies these graduates will engage with during their careers, but we do know they will always need to work in teams and understand the bigger picture.

Along with other universities in the nation, we are expanding our professional student options – students who are re-engaging with the university to update their skills while remaining on the job. These programs might range from a professional master's program with an accelerated time frame to a certificate program to get up to speed on an emerging technology. Another area we are looking to expand is what one might call "deep collaboration" where technical professionals from the government come spend extended time with research labs and groups at the university. Such programs are highly mutually beneficial to both the

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university researchers as well as the professional engineers. These sorts of programs I believe will be become increasingly important to our technical professional workforce.

Universities also play a key role in developing and disseminating next-generation engineering principles. Lean engineering, design thinking, additive manufacturing and additive construction are important examples. Design thinking helps break down complex, multidimensional design problems into a manageable framework while lean engineering realizes those designs through highly efficient production and manufacturing. A challenge here, however, is not to sacrifice the technical foundations upon which all these concepts are built.

Additive manufacturing and additive construction will play vital roles in any long-term space missions. Whether the mission is a base on the moon or a manned mission to Mars, replacements parts cannot be stocked – they will need to be printed as they are needed. Any larger-scale structures on the surface of a moon or planet will require using native materials and reliable additive construction technologies.

The role of advanced materials will also be increasingly important in the next generation of space systems design. Nanophase materials such as graphene have been studied for several decades, but are now emerging as useful technologies. Our Center for Graphene Research and Innovation designed a graphene-enhanced polymer material that was just launched this Saturday from Wallops Flight Facility in Virginia to be tested on the International Space Station for protection against hyper-velocity impacts. We and others are exploring graphene enhancements of many technologies relevant to NASA missions – from microfiltration to high-efficiency solar panels. Let me be clear: Undergraduate and graduate students play a key role in the development of such technologies.

Perhaps a less obvious, but increasingly important, skill set around space activities are legal and regulatory issues. UM is home to the National Center of Air and Space Law along with Journal of Space Law since 1973. As space activities in the private sector continually grow, appropriate light-touch legal frameworks need to be developed and studied to best inform decision makers. UM is preparing this workforce with the first Air and Space Law Masters Program in the nation.

Let me also take a moment to emphasize the importance of the NASA Space Grant program which provides incredible space science and engineering research opportunities to graduate and undergraduate students across a wide swath of the country. I can tell you from personal experience that nothing can hook a young college student into a NASA career faster than working with a team on a real-world problem.

I thank the subcommittee for your attention and would welcome any questions.