

Chairman Cantwell, Ranking Member Wicker and members of the committee, thank you for the opportunity to speak today about a topic that is both timely and critical to our nation's global competitiveness and security. As many experts have highlighted, US research investment has fallen woefully behind our adversaries in areas that are critical to our national security. The topics of this hearing are certainly at the top of that list if we are to sustain and protect our Nation as a world leader.

My perspective comes as the Director of the High Performance Computing Collaboratory at Mississippi State University where I have served for the past 30 years. Our high performance computing capacity provides support for research in artificial intelligence, autonomous vehicles, cybersecurity, data science, weather modeling and other areas of applied research vital to the prosperity of the United States and the world. I am extremely proud of the national presence MSU holds in high performance computing and the advancement of science enabled by our HPC systems. Mississippi State University has had a presence on the world's TOP500 fastest computers list since 1996. At its debut in 2019 our *Orion* supercomputer, a 5.5 petaFLOPS system operated in partnership with NOAA, ranked 60th in the world and 5th in U.S. academia. Much of the growth and success Mississippi State University has enjoyed in high performance computing can be directly attributed to the partnerships we have built with agencies such as NOAA, NSF, the Department of Agriculture's Agriculture Research Service, and the DOD.

With respect to international HPC capability, according to the TOP500 Supercomputing Sites list, in 2012 the U.S. was home to more than 50% of the world's 500 fastest supercomputers while China had less than 14%. Today the U.S. is home to only 23% of the world's 500 fastest computers while China has increased their share to over 45%. Furthermore, China has

significantly increased HPC funding to match or exceed the U.S. HPC capacity at very high end.

The fastest system on the latest TOP500 list is located in the US, however many experts are confident that China has secretly built two systems that rival the performance of the fastest US system. Simply put, our adversaries are outspending us in high performance computing.

As you well know, Artificial Intelligence and Blockchain rely heavily on HPC, and the next major advance in computing will most likely occur with Quantum technology. Quantum holds the potential to solve complex problems that are unable to be solved with classical computing systems, but it also presents many challenges that must be overcome with significant investments. As an example, in the field of cybersecurity, quantum technology will place much of today's public-key encryption at risk. The development of robust quantum-based encryption techniques and the use of quantum machine learning to detect and defeat novel cyber-attacks are crucial. These challenges are not just in the development and maturation of hardware, but perhaps more importantly, the creation and training of a knowledgeable workforce that is able to develop new software tools and enable access to the broader scientific community without a need for understanding quantum physics.

The recent passage of the CHIPS and Science Act has been heralded as a necessary action for the United States to match investment in these critical technology areas that are being heavily funded by those in the international community looking to displace the US as a leader in technology development and deployment. We have certainly experienced that recently with the global chip shortage based on China dependence, and we have strong evidence that their investment in quantum and AI is clearly outpacing our investment. The CHIPS and Science Act is an excellent first step to combat this issue. I would also like to applaud the bill sections related

to EPSCoR funding and the impacts it will have to vastly expand the talent base in the critical fields necessary to remain a global leader. We have proven that EPSCoR institutions like MSU can be a national leader in technology fields such as high performance computing, contributing to the advancement of necessary technology while playing a significant role in cultivating the workforce for tomorrow's innovative leaders.

I offer the following recommendations for the committee to consider. To remain globally competitive and protect our future, investments such as the CHIPS and Science Act are critical to maintain our national security to mitigate being outpaced by adversary nations whose primary goal is to relegate the US to a second-tier technology nation. We must utilize all the expertise that exists throughout the US and grow the technology workforce, not just in existing US technology centers but throughout the country. Finally, federal, state and university partnerships will be critical to addressing these issues and be unified in developing solutions.

Chairman Cantwell, Ranking Member Wicker, members of the committee, I thank you for the opportunity to testify before you today. Bipartisan support of technology and innovation is critical to our competitiveness and Mississippi State University stands prepared to be full participants in support of your efforts.