AI in the Everyday:

Current Applications and Future Frontiers in Communications and Technology

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Chairman Hudson, Ranking Member Matsui, and members of the subcommittee, thank you for the opportunity to be with you and testify today. I am Jim Shea, CEO of DeepSig Inc., a small business focused on bringing Artificial Intelligence (AI) software for Wireless Communications and Sensing to market. Today, I will outline how AI is transforming 5G, enabling superior spectrum management, and providing essential capabilities for national defense and everyday applications.

DeepSig Inc., headquartered in Arlington Virginia, was founded in 2016 by me and Dr. Tim O'Shea to evolve and bring to market AI wireless technology that Tim developed at Virginia Tech. The company's 48 employees are focused on delivering AI sensing and communications software to meet commercial and defense needs.

Working with partners such as Intel, Nvidia, and Qualcomm, DeepSig's AI based OmniPHY® software replaces traditional wireless processing algorithms with AI in 5G systems. When you make a call, the signal from your mobile phone travels to a base station often reflecting from multiple buildings and obstacles while competing with interfering signals. Traditional wireless algorithms employ a simplified one-size fits all approach to pull signals out of the noise. AI on the other hand, can learn the local wireless environment by monitoring received signals to rapidly develop AI models that better sort signals from noise and impairments, dramatically improving spectrum efficiency and reducing dropped calls. This breakthrough extends to 5G massive MIMO technology – flat panel antenna arrays that focus wireless signals at individual users. Traditional massive MIMO algorithms use a library of fixed antenna beams but AI can learn the best beam shapes and directions for each user to optimize performance and the user experience. Taken together, these and other AI technologies are referred to as AI-Native Wireless. AI-Native is seen as a key enabling capability in 6G as it evolves through the standardization process.

US leadership in AI-Native coupled with Open Radio Access Networks (ORAN) that replaces custom hardware with commodity servers will dramatically reduce cost and offer a path to compete with Huawei and other concerning network vendors.

AI is enabling rapid sensing of the wireless environment. Traditional sensing approaches are painfully slow and require significant analysis by skilled engineers and weeks or months of effort to develop code when new signals are encountered. DeepSig's OmniSIG® AI sensing software has been trained to detect, classify, and locate nearly all types of signals ranging from narrowband handheld radios to wideband radar often up to 1000 times faster than traditional approaches. Like other AI systems, OmniSIG can learn new signals in a matter of hours after being presented with signal data.

Exponentially increasing mobile data needs for consumer, industrial and defense applications require more wireless spectrum. Sharing with DOD and other incumbent users is under study but only on a limited scale. The CBRS (Citizens Broadband Radio Service) band shares spectrum with US Navy ship-based radars; however, new proposed bands have incumbent ground and airborne users that move far faster than ocean-based ships. With the integration of AI, rapid detection can inform commercial networks to vacate or steer wireless beams away from the incumbent user.

Similarly, AI sensing can detect and locate unintended interference from malfunctioning devices that impair 5G and other wireless systems. Currently, wireless carriers locate interfering sources by expensive "truck rolls' of field service and engineering teams. AI offers a way to automate this process. Rather than responding to customer complaints of poor service, DeepSig is working to implement continuous monitoring and has demonstrated the ability to locate malfunctioning devices before interference increases to a level that impairs a network.

Another important and timely application involves addressing wireless intrusions and base station spoofing. Persistent and growing threats concern both network owners and the government due to their increasing scale and sophistication. By continuous monitoring of spectrum, AI can detect fake base stations such as those discovered last month in Turkey that were covertly transmitting information about the local Uyghur population back to China.

Finally, as we have seen in Ukraine, spectrum sensing and electronic warfare are capabilities where the US must regain leadership to protect our forces. Adversaries continually change their signals and can only be countered by timely detection. The ability to quickly learn new signals is paramount to ensure our defense systems can quickly respond to threats. Small innovative businesses such as DeepSig, deliver off-the-shelf AI software, accelerating the likes of Anduril, CACI, Lockheed Martin and other partners, giving them the ability to respond to rapidly changing threats.

Leadership in AI-Native and wireless sensing technologies offers the U.S. a path to reclaim global leadership in mobile wireless technology. A special thank you to this committee for your leadership on helping the NTIA's Public Wireless Supply Chain Innovation Fund become a reality. DeepSig has been honored to receive three grants in partnership with Airspan, Qualcomm, Fujitsu and is rapidly advancing our AI software into 5G and 6G to take part in the resurgence of US wireless leadership.

The convergence of AI and wireless represents a transformative moment. The United States has the innovation ecosystem, technical talent, and industrial partnerships

necessary to lead this transformation. Working together, American industry and Government can ensure that the next generation of wireless infrastructure and sensing technology is Made in America.