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Request for Information on the National Cyber-Physical Systems Resilience Plan

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I am responding to the Request for Information on “a National Plan for Cyber-Physical Systems Resilience” on behalf of the Link Lab, an interdisciplinary research lab focusing on cyber-physical systems with over 50 faculty members and 250 student researchers housed within the University of Virginia Engineering School. I serve as the director of Link Lab and as professor of civil and environmental engineering at the University of Virginia. We support the “whole-of-government research and development (R&D) plan related to cyber-physical resilience across systems that may be local, regional, or national in scope.” Link Lab is devoted to the mission of advancing cyber-physical systems broadly including those related to smart cities, smart health, and robotics where resilience is central. In the context of smart cities and smart civil infrastructure, transformation of these systems from physical to cyber-physical systems presents unique opportunities and challenges, as the February 2024 PCAST Report to the President on a Strategy for Cyber-Physical Resilience captures. Interdisciplinary R&D at universities in partnership with government and industry must be encouraged to advance our Nation’s cyber-physical resilience. New education and workforce development efforts in cyber-physical system resilience are also important, as the PCAST report points out. That is why, with support from the National Science Foundation, we have created a graduate certificate program in Cyber-Physical Systems that graduate students in engineering and computer science can earn alongside their graduate degree in a traditional engineering or computer science discipline. As a member of the Virginia Commonwealth Cyber Initiative, we are working with universities across Virginia to integrate cybersecurity into our research, teaching, and training missions for the Link Lab and the University of Virginia more broadly. We also share the viewpoint in the PCAST report that artificial intelligence (AI) is an important tool for making cyber-physical systems resilient. Some examples of research topics we believe are important toward this goal include the following. AI-Enhanced Predictability: Developing sophisticated AI systems that significantly improve the accuracy and reliability of forecasting, planning, and adaptability in system operations. These advanced AI solutions lead to more robust and efficient operations, reducing uncertainties and increasing resilience to disruptions, ultimately enabling businesses and governments to optimize their scheduling, management, and resource allocation with unprecedented precision. Human-AI Copiloting: Creating intelligent assistive technologies that work alongside human operators, augmenting their decision-making capabilities and productivity. These AI systems act as collaborative partners, providing real-time insights, suggestions, and support to enhance human performance across various domains, from complex data analysis to creative problem-solving. Trustworthy and Energy-Efficient AI: Focusing R&D to advance reliability, energy efficiency, transparency, and ethical integrity of AI systems, ensuring they produce accurate, fair, and safe outcomes while maintaining accountability and fostering confidence among users and stakeholders. This approach aims to create AI technologies that not only perform their intended functions with high precision and minimal environmental impact but also adhere to stringent ethical standards and promote open communication thereby building trust and facilitating responsible adoption across various sectors of society. We support the need for cyber-physical resilience for the vast and growing examples of cyber-physical systems of national, regional, and local significance. We are actively working to advance knowledge and practice in this field at the University of Virginia, while also training future engineers and computer scientists in the

unique aspects and considerations of cyber-physical systems. We believe an approach that supplements traditional education in established disciplines with training in the new and emerging field of cyber-physical systems is needed to produce future leaders with the breadth and depth of knowledge needed to advance resilient cyber-physical systems. Jonathan L. Goodall, PhD, PE, F.ASCE Director, UVA Engineering Link Lab Professor, Civil and Environmental Engineering University of Virginia