Testimony of

Dr. Walter G. Copan
Under Secretary of Commerce for Standards and Technology
Director
National Institute of Standards and Technology (NIST)
United States Department of Commerce

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Subcommittee on Research and Technology

A Review of the National Institute of Standards and Technology Fiscal Year 2020 Budget Request

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Introduction
Madam Chairwoman Stevens and Ranking Member Baird. Thank you for the opportunity to testify today before the Committee on Science, Space, and Technology's Subcommittee on Research and Technology on the programs and priorities of the National Institute of Standards and Technology—known as NIST. Today I will highlight the unique mission and role NIST plays in measurements science, standards, technology, and innovation. I will cover my priorities as we position NIST to meet our nation's needs of the future of our economic prosperity and industrial competitiveness. I am deeply grateful to this Committee for your work on behalf of NIST, its people, and programs.

The President's FY 2020 Budget request continues this Administration's efforts to manage federal investment levels in order to put the nation on a sustainable fiscal path. The budget request for NIST is aligned with the Administration's key priorities including promoting a healthy economy and maintaining a strong national defense. The FY 2020 request for NIST totals $686.8 million and will support the Administration's efforts to lead the industries of the future, prioritizing investment in support of artificial intelligence, quantum science, advanced manufacturing, microelectronics, and advanced fifth-generation (5G) communications technologies, while maintaining NIST's core measurements science, standards, and technology development capabilities that are essential to driving innovation and economic competitiveness.

NIST's Unique Mission
NIST's mission is crucial for U.S. commerce and global competitiveness. NIST is the best in the world at performing its metrology mission, as the world witnessed again in the Redefinition of the International System of Units, the SI, by the unanimous vote of the member nations in Versailles on November 16, 2018. NIST's leadership in this monumental achievement for universally accurate measurements based upon the unchanging constants of nature, is rooted in our core values of excellence and perseverance, integrity and inclusivity. The quality of our research and our people is borne out by numerous awards—including NIST's five Nobel prizes.

SCIENTIFIC AND TECHNICAL RESEARCH SERVICES (STRS) ($611.7 million)
The NIST research programs work at the frontiers of measurement science to ensure that the U.S. system of measurements is firmly grounded in sound scientific and technical principles. Today, the NIST laboratories address increasingly complex measurement challenges, ranging from the very small (nanoscale devices for advanced computing) to the very large (vehicles and buildings), and from the physical (resilient infrastructure) to the virtual (cybersecurity and data science). As new technologies develop and evolve, NIST's measurement research and services remain central to national defense, homeland security, trade, and innovation.

Advanced Communications, Networks and Scientific Data Systems ($40.2 million)
NIST's Advanced Communications, Networks, and Scientific Data Systems activities enable secure, reliable, high-speed wireless and wireline communications critical to U.S. economic competitiveness, safety, and security. NIST measurement science research and support for the development of standards accelerates the deployment of next-generation communication technologies, including 5G, a term used to describe future wireless networks that will be faster and more reliable. These technologies will be necessary for self-driving cars, internet of things (IoT) applications, drones, and future artificial intelligence (AI) systems. NIST is committed to

solving the measurement and deployment challenges of these fast-moving fields to help the U.S. achieve and maintain global leadership in these areas. This request funds measurement science research and standards development that will strengthen the growth of 5G communications, smart systems, and AI. NIST will consolidate efforts on its highest priority capabilities and research.

In the area of AI, NIST will focus an additional $8.0 million to develop resources needed by users of AI to train and test AI systems, model AI behavior and compare systems. NIST will also apply AI solutions to its research in advanced materials, robotics, and more. This requested increase also supports NIST's role in providing standard leadership and expertise that is essential for the U.S. to reap the economic benefits of emerging technologies such as AI.

Advanced Manufacturing and Material Measurements ($117.5 million)
NIST has partnered with the U.S. manufacturing sector for more than a century and has a proven track record of delivering the tools and technical expertise that existing manufacturers and aspiring start-ups need. NIST's Advanced Manufacturing and Material Measurements activities provide industry with precision measurement technologies, tests, protocols, trusted systems, and world-class scientific and engineering knowledge through targeted research across a broad portfolio—including advanced materials development, advanced sensing, biomanufacturing, and smart manufacturing systems.

The FY 2020 request would refocus an additional $10 million to support advances and breakthroughs in measurement science, standards, and material characterization by NIST that will accelerate the design, development, and manufacturability of next generation microelectronics. NIST will specifically focus on challenges around nanophotonic, which will also directly support the agencies efforts in quantum engineering.

Cybersecurity and Privacy ($84 million)
NIST is the Department of Commerce's lead agency on Cybersecurity issues.
NIST's Cybersecurity and Privacy activities strengthen the security of our digital world through a portfolio bridging foundational and applied cybersecurity research, and through the development of publicly available standards and technical guidance. NIST's sustained outreach supports the effective application of standards and best practices enabling the adoption of practical cybersecurity, advanced cryptography, and privacy approaches, including leadership in the development of a national Privacy Framework. Through internal research and collaboration with stakeholders, NIST addresses the nation's current and future measurement science needs. The President's FY 2020 request fully funds NIST current portfolio of cybersecurity activities including work on IoT cybersecurity, maintaining the National Cybersecurity Vulnerabilities Database, and the NIST Cybersecurity Center of Excellence.

Exploratory Measurement Science ($65.7 million)
NIST's mission requires deep expertise in a broad range of disciplines. To best position NIST to support U.S. technological interests well into the future, it is essential that NIST maintain a portfolio of exploratory measurement science research. This portfolio includes investing in higher-risk and potentially transformative projects selected in a competitive internal process, and

the NIST National Research Council Postdoctoral Research Associateship Program that brings researchers of exceptional promise to NIST.

Fundamental Measurement, Quantum Science, and Measurement Dissemination ($191.4 million)
The President's FY 2020 Budget continues to support NIST measurement science and standards efforts to address our nation's most pressing technological challenges and economic opportunities, among which is the U.S. priority to attain quantum supremacy. Continued U.S. leadership in quantum technology is critical for both national security and future economic competitiveness. The recent achievements by other nations, including China's significant advances in quantum communications, adds urgency to the issue.[1]

As part of the FY 2020 request NIST will prioritize an additional $10 million towards its efforts in Quantum Information Science. Continued U.S. leadership in quantum technology is critical for both national security and future U.S. economic competitiveness. The recent achievements by other nations, like China's significant advances in quantum communications, adds urgency to the issue. The requested funds will also enable NIST to expand its existing joint institutes with the University of Maryland-College Park and the University of Colorado-Boulder, and potentially additional academic research-focused partnerships that could materialize an entirely new mechanism for NIST to engineer quantum science breakthroughs into functional quantum devices.

Health and Bioscience ($16.8 million)
NIST is paving the way for a vibrant U.S. biotechnology market by developing measurements that enable the reproducibility of biomedical research results to ensure the efficacy and safety of treatments and ultimately increase confidence in clinical decisions. NIST's programs range from supporting underlying technologies and measurements for precision medicine and medical imaging to accelerating understanding in synthetic biology and genomics. New and improved measurement capabilities provide the basis for industries to harness this information for future medical technologies.

Breakthrough technologies such as gene sequencing, gene editing, and advanced imaging have laid the foundation for significant growth opportunities in fields beyond medicine and health, such as chemical manufacturing, energy, and agriculture. NIST is focusing its bioscience efforts to build the measurement science capabilities that will support progress in these emerging areas.

NIST User Facilities ($47.0 million)
NIST operates two unique and valuable user facilities that provide U.S. scientists with access to cutting-edge expertise and capabilities to perform innovative research beyond the reach of the user's own laboratory. The NIST Center for Neutron Research (NCNR) features world-class neutron instrumentation and expertise in the development and application of neutron measurement technologies. The Center for Nanoscale Science and Technology (CNST) provides users rapid access to state-of-the-art tools needed to fabricate and characterize nanoscale structures, devices, and materials. These facilities annually provide over 5,000 scientists from

[1] Emerging Technology from arXiv, "First Object Teleported from Earth to Orbit," 10 July, 2017, https://www.technologyreview.com/s/608252/first-object-teleported-from-earth-to-orbit/

academia, industry, and government unique world-class capabilities that help move the state-of-the-art forward in advanced materials, quantum science, energy, medicine, and other critical technology areas.

Physical Infrastructure and Resilience ($46.5 million)
NIST's Physical Infrastructure and Resilience activities support the safety, interoperability, and resilience of the nation's infrastructure at the component, structure, and system levels. NIST's research supports the development of building codes that make the built environment healthier for occupants, more resilient against hazards, and safer for both residents and first responders. In collaboration with policy makers, building officials, and planning groups, NIST produces guides to help communities integrate resilience into their economic development, zoning, mitigation, and other local planning activities that impact buildings, public utilities, and infrastructure systems.

Industrial Technology Services (ITS) Account ($15.2 million)
NIST's extramural programs, help U.S. industry develop and implement new technology, develop robust supply chains, implement cybersecurity capabilities, and refine manufacturing their systems for efficiency and effectiveness, making U.S. corporations more competitive in the global economy.

The FY 2020 budget request for Manufacturing USA is $15.2 million, $0.2 million above the FY 2019 Enacted level. Manufacturing USA, the National Network for Manufacturing Innovation serves to create effective robust manufacturing research infrastructure for U.S. industry and academia to solve industry-relevant problems. The Manufacturing USA consists of linked Institutes for Manufacturing Innovation with common goals, but unique concentrations. In an Institute, industry, academia, and government partners leverage existing resources, collaborate, and co-invest to nurture manufacturing innovation and accelerate commercialization. The request continues to fund the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) manufacturing institute as well as the coordination of the Manufacturing USA network.

The FY 2020 President's Budget request continues the discontinuation of federal funding for the Hollings Manufacturing Extension Partnership (MEP) program, a reduction of $140 million from the FY 2019 Enacted level. MEP is a federal-state-industry partnership that provides U.S. manufacturers with access to technologies, resources, and industry experts. The MEP program consists of Manufacturing Extension Partnership Centers located across the country that work directly with their local manufacturing communities to strengthen the competitiveness of our Nation's domestic manufacturing base. In FY 2020, no federal funding will be provided for MEP Centers and the Centers will be required to rely on non-Federal funding.

CONSTRUCTION AND MAINTENANCE OF RESEARCH FACILITIES AND INFRASTRUCTURE (CRF) ($59.9 million)
The NIST Construction of Research Facilities (CRF) appropriation funds NIST construction activities, including the maintenance, repair, improvements, and major renovation of facilities occupied and used by NIST in Gaithersburg, Maryland; Boulder and Fort Collins, Colorado; and Kauai, Hawaii, to meet the current and future measurements, standards, research and technology

needs of the Nation. The funds requested in FY 2020 support Safety, Capacity, Maintenance, and Major Repairs (SCMMR) and Construction and Major Renovations. The request supports staff salaries and recurring preventive maintenance contracts and materials.

NIST's Building 1 project at the Boulder campus has been identified as a candidate project to be funded through the General Services Administration (GSA) Federal Capital Revolving Fund. The Fund would provide up-front funding, estimated to be $288.0 million, for renovations of critical laboratory space in Boulder. At the FY 2020 base funding level, NIST would repay this GSA revolving fund through annual discretionary appropriations in 15 annual payments of $19.2 million.

Summary

NIST maintains its longstanding commitment to advancing the frontiers of measurements science in order to accelerate innovation and to increase the competitiveness of U.S. industry. NIST's broad technical portfolio and scientific and engineering depth positions the agency to contribute effectively and rapidly to emerging national needs. The 2020 Budget focuses NIST's research and services on key national priorities, such as quantum science and artificial intelligence. With NIST's dedicated technical staff, one-of-a-kind facilities, and the Institute's trusted, objective, non-regulatory role, we are well positioned to continue delivering a positive impact on the U.S. economy, quality of life, and national security. With the continued support of this Committee, NIST will continue to thrive in its important mission to advance U.S. innovation and industrial competitiveness.

I am happy to answer any question you may have.

Walter G. Copan

Under Secretary of Commerce for Standards and Technology and NIST Director

Dr. Walter G. Copan was confirmed by Congress as Under Secretary of Commerce for Standards and Technology and NIST Director on October 5, 2017.

As NIST Director, Dr. Copan provides high-level oversight and direction for NIST. He has had a distinguished and diverse career as a science and technology executive in large and small corporations, U.S. government, nonprofit, and other public-sector settings.

Dr. Copan formerly served as president and CEO of the IP Engineering Group Corporation, providing services in intellectual property strategy, technology commercialization and innovation. Until June 2017, he was founding CEO and chairman of Impact Engineered Wood Corporation, an advanced materials technology company. He also is a founding board member of Rocky Mountain Innovation Partners, where he led technology transfer programs and innovation services on behalf of the U.S. Air Force Academy, U.S. federal labs and academic institutions and helped foster entrepreneurial businesses in the Rocky Mountain West. He also served with the National Advisory Council to the Federal Laboratory Consortium for more than five years, providing industry inputs to advance the U.S. economic impacts of the federal laboratory system.

From 2010 to 2013, Dr. Copan served as managing director of Technology Commercialization and Partnerships at the Department of Energy's Brookhaven National Laboratory (BNL). Among his accomplishments were leading the creation and implementation of the new DOE technology transfer mechanism, "Agreement for Commercializing Technology" (ACT), to facilitate collaborations between the federal labs and U.S. corporations. He led the "Startup America" initiative on behalf of DOE for entrepreneurial business creation, and he initiated the DOE's new Small Business Innovation Research—Technology Transfer (SBIR-TT) program, which built upon the experiences of NIST. He served as founding partner and board member of the "Accelerate Long Island" alliance for innovation, economic development and early stage investment.

From 2005 to 2010, Dr. Copan was executive vice president and chief technology officer at Clean Diesel Technologies, Inc., an international technology development and licensing firm. He spearheaded the company's transformation, growth and listing on NASDAQ (CDTI), as well as the company's subsequent merger. Prior to joining CDTI, Dr. Copan served at the DOE's National Renewable Energy Laboratory (NREL) as Principal Licensing Executive, Technology Transfer. There, he led organizational changes that strengthened relationships with industry and the investment community and led to the more productive commercialization of energy-related technologies.

After earning dual B.S./B.A. degrees in chemistry and music from Case Western Reserve University in 1975, Dr. Copan began his career in chemicals and materials research at the Lubrizol Corporation (now part of the Berkshire Hathaway Group). He earned a Ph.D. in physical chemistry from Case Western in 1982, and subsequently held leadership positions at Lubrizol in research and development, strategy, business unit management, venture capital, and mergers, acquisitions and strategic alliances in the U.S. and abroad. As managing director, Technology Transfer and Licensing, from 1999 to 2003, he was responsible for Lubrizol's corporate venturing and open innovation, technology strategy, business development, intellectual assets and the technology licensing business.

Dr. Copan is a patent holder, has authored numerous professional publications and presentations, and has served on the boards of many organizations, including the Licensing Executives Society (LES) USA and Canada, where he recently served as regional vice president for LES USA. He has contributed to the U.S. National Academy of Sciences, the Council on Competitiveness, the World Intellectual Property Organization and the United Nations on innovation, technology transfer, energy, and economic development matters.