

**A REVIEW OF THE ADMINISTRATION'S FEDERAL
RESEARCH AND DEVELOPMENT BUDGET
PROPOSAL FOR FISCAL YEAR 2021**

HEARING
BEFORE THE
**COMMITTEE ON SCIENCE, SPACE,
AND TECHNOLOGY**
HOUSE OF REPRESENTATIVES
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**A REVIEW OF THE ADMINISTRATION'S
FEDERAL RESEARCH AND DEVELOPMENT
BUDGET PROPOSAL FOR FISCAL YEAR 2021**

THURSDAY, FEBRUARY 27, 2020

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Committee met, pursuant to notice, at 10:04 a.m., in room 2318 of the Rayburn House Office Building, Hon. Eddie Bernice Johnson [Chairwoman of the Committee] presiding.

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
HEARING CHARTER**

*A Review of the Administration's Federal Research and Development Budget
for Fiscal Year 2021*

**Thursday, February 27, 2020
10:00 am – 12:00 pm
2318 Rayburn House Office Building**

PURPOSE

On Thursday, February 27, 2020, the Committee on Science, Space, and Technology will hold a hearing to examine the Administration's proposed Fiscal Year 2021 (FY21) budget for Federal research, development, demonstration, and commercial application programs within the Committee's jurisdiction and to discuss related policy issues.

WITNESS

- **Dr. Kelvin K. Droegemeier**, Director, White House Office of Science and Technology Policy

OVERVIEW

Overall Federal R&D Spending¹
(dollars in millions)

Agency	FY 19 Actual	FY 20 Estimate	FY 21 Request	FY21-FY20	
				\$	%
Department of Defense	54691	64544	59831	-4713	-5.85
Department of Health and Human Services	38511	40818	37875	-2943	-7.21
Department of Energy	18271	19219	16051	-3168	-16.48
National Aeronautics & Space Administration	10698	14057	13334	-723	-5.14
National Science Foundation	6586	6752	6328	-424	-6.28
Department of Agriculture	3026	2941	2769	-172	-5.85
Department of Commerce	1959	1948	1506	-442	-22.69
Department of Transportation	1071	1134	594	-540	-47.62
Department of Homeland Security	668	532	450	-82	-15.41
Department of Veterans Affairs	1370	1313	1351	38	2.89
Department of the Interior	958	973	725	-248	-25.49
Environmental Protection Agency	489	492	318	-174	-35.37
Department of Education	248	259	230	-29	-11.20
Smithsonian Institution	339	330	328	-2	-0.61
Veterans Affairs	1370	1313	1351	38	2.89
Total	138885	155312	141690	-13622	-8.77

Shading indicates agencies within the Science, Space, and Technology Committee's jurisdiction.

¹ Fiscal Year 2021 Analytical Perspectives, Budget of the U.S. Government, OMB, p. 233.
https://www.whitehouse.gov/wp-content/uploads/2020/02/spec_fy21.pdf

The President's FY21 budget proposal includes a total of \$141.7 billion for research and development (R&D) across all agencies, a \$1.4 billion or 9% decrease from the FY20 enacted level. Under the proposal, defense-related R&D spending would decrease by \$4.7 billion or 6% to \$59.8 billion and health-related R&D would decrease by \$2.9 billion or 7% to \$37.9 billion. Therefore, the total request for non-defense and non-health specific R&D, a majority of which is in the Science Committee's jurisdiction, is \$38.6 billion, which represents a 13% decrease from the FY20 level. This amount includes basic and applied research, experimental development, and facilities and equipment.

The Administration proposes to reduce R&D spending across all agencies in the Committee's jurisdiction. However, the aggregate numbers mask variation across agencies and programs. The request includes significant increases in areas such as artificial intelligence, quantum information science, and deep space exploration, while reducing spending in climate science, NASA science missions, energy technologies, and STEM education.

AGENCY HIGHLIGHTS

National Aeronautics and Space Administration (NASA)

NASA Spending²
(dollars in millions)

	FY19 Actual	FY20 Enacted	FY21 Request	Change FY21 - FY20	
				Amount	Percent
National Aeronautics and Space Administration	21,500.0	22,629.0	25,246.0	2,617.0	11.6%
Science	6,905.7	7,138.9	6,306.5	-832.4	-11.7%
Aeronautics	725.0	783.9	819.0	35.1	4.5%
Space Technology	926.9	1,100.0	1,578.3	478.3	43.5%
Exploration	5,050.8	6,017.6	8,761.7	2,744.1	45.6%
Space Operations	4,639.1	4,140.2	4,187.3	47.1	1.1%
Education	110.0	120.0	0.0	-120.0	-100.0%
Safety, Security, and Mission Services	2,755.0	2,913.3	3,009.9	96.6	3.3%
Construction & Environmental Compliance & Restoration	348.2	373.4	539.1	165.7	44.4%
Inspector General	39.3	41.7	44.2	2.5	6.0%

The Administration has requested \$25.2 billion for NASA for FY21, an increase of nearly \$2.7 billion, or 12%, over the FY20 enacted appropriation. Nearly half, or \$12.4 billion, of the overall request would be devoted to NASA's Moon to Mars campaign, an exploration effort to return humans to the surface of the Moon by 2024 and eventually send astronauts to Mars. The total Moon to Mars request is 40% (\$3.5 billion) higher than the campaign's FY20 appropriation.

² https://www.nasa.gov/sites/default/files/atoms/files/fy2021_congressional_justification.pdf

The Human Exploration and Operations Mission Directorate (HEOMD) manages the largest component of the Moon to Mars request, the Deep Space Exploration Systems account (\$6 billion under the FY20 appropriation). For FY21, the Administration is requesting \$8 billion, which would fund commercial development of a new lunar Human Landing System (\$3.4 billion) and continued development of the Space Launch System (\$2.3 billion), Orion crew vehicle (\$1.4 billion), and Lunar Gateway (\$740 million). HEOMD also oversees the Low Earth Orbit and Spaceflight Operations account, which includes all International Space Station operations and research activities, for which the Administration is requesting \$4.2 billion in FY21, 1% below the FY20 appropriation.

The Administration is proposing \$1.6 billion in FY21 for Exploration Technology, which is the account managed by the Space Technology Mission Directorate and was appropriated \$1.1 billion in FY20. Most (\$1.2 billion) of the account's FY21 proposal would go toward maturation of early-stage Moon to Mars technologies in areas such as In-Situ Resource Utilization, and advanced power and propulsion.

The request proposes \$6.3 billion for the NASA Science Mission Directorate (SMD), nearly 12% (\$830 million) below the FY20 appropriation. Under the FY21 proposal, the budgets of each of the four SMD divisions would be cut relative to their FY20 appropriation: Astrophysics by 36%, Earth Science by 10%, Heliophysics by 13%, and Planetary Science by 2%. The FY21 request would increase spending, by \$136 million (19%), on science activities that inform human exploration of the Moon and Mars, including the Commercial Lunar Payload Services (CLPS) program and a new Mars Ice Mapper mission. The FY21 request for SMD proposes terminating programs the Administration deems are of lower priority, including two Earth Science missions under development, the Plankton, Aerosol, and Climate Ecosystem (PACE) and the Climate Absolute Radiance and Refractivity Observatory Pathfinder (CLARREO-PF); one Astrophysics mission under development, the Wide Field Infrared Survey Explorer (WFIRST); and one operating Astrophysics mission, the Stratospheric Observatory for Infrared Astronomy (SOFIA). The Administration proposed to cancel WFIRST in the last two budget requests, and PACE and CLARREO-PF in the last three, but Congress fully funded the missions each year.

As in the last three NASA budgets, the Administration's FY21 budget proposes eliminating NASA's Office of STEM Engagement (formerly the Office of Education) in order to "[redirect] those funds to NASA's core mission of exploration." For FY20, Congress supported the continuation of the Office of STEM Engagement and appropriated \$120 million for its activities. The Office of STEM Engagement supports the National Space Grant College and Fellowship Program (\$48 million appropriated in FY20), the NASA Established Program to Stimulate Competitive Research (EPSCoR, \$24 million appropriated in FY20), the Minority University Research and Education Project (MUREP, \$36 million appropriated in FY20), and activities in evaluation and informal education. The FY21 proposal would continue support for STEM activities, such as internships and fellowships, within the Mission Directorates, including the Science Activation program under SMD at \$46 million, which currently has 24 ongoing awards to deliver SMD's content and expertise to learners of all ages.

The request would increase the budget of the Aeronautics Research Mission Directorate (ARMD) to \$819 million, 4.4% over the FY20 enacted level. The ARMD budget request supports research that enables the transformation of aviation, including ongoing programs such as the supersonic Low Boom Flight Demonstrator, Urban Air Mobility Grand Challenges, and activities toward integration of Unmanned Aircraft Systems into the national airspace.

Under the Mission Support Directorate (MSD), the FY21 request proposes increasing the budgets of the Safety, Security, and Mission Services and Construction and Environmental Compliance accounts by 3% and 44%, respectively, relative to the FY20 appropriation. The proposed increases for both accounts are largely in support of Moon to Mars activities.

Department of Energy (DOE) R&D Programs

DOE R&D Spending³
(dollars in millions)

	FY19 Actual	FY20 Enacted	FY 2021 Request	Change FY21 - FY20	
				Amount	Percent
Department of Energy R&D	11,696.1	12,840.4	8,369.0	-4,471.4	-34.8%
Energy Efficiency and Renewable Energy	2,379.0	2,790.0	720.0	-2,070.0	-74.2%
Electricity	156.0	190.0	195.0	5.0	2.6%
Cybersecurity, Energy Security, and Emergency Response	120.0	156.0	185.0	29.0	18.6%
Fossil Energy R&D	740.0	750.0	731.0	-19.0	-2.5%
Nuclear Energy	1,326.1	1,493.4	1,180.0	-313.4	-21.0%
Office of Science	6,585.0	7,000.0	5,838.0	-1,162.0	-16.6%
ARPA-E*	366.0	425.0	-311.0	-736.0	-173.2%
Loan Programs*	24.0	36.0	-169.0	-205.0	-569.4%

The Trump Administration is proposing to cut DOE's non-defense research, development, and demonstration budget by 34.8% overall compared to FY20 enacted levels. These proposed cuts include the elimination of the Advanced Research Projects Agency – Energy (ARPA-E) and the Loan Programs Office (LPO).

Most of DOE's other energy technology offices would receive significant cuts from FY20 funding levels. The Office of Energy Efficiency and Renewable Energy (EERE) would receive the largest cut of 74.2% (or \$2.07 billion). Within EERE's Sustainable Transportation program, the Administration would cut Vehicle Technologies by 75.5%, Bioenergy Technologies by 68%, and Hydrogen and Fuel Cell Technologies by 70.7%. Under its Renewable Energy program, the Budget Request calls for a 58.2% cut to Solar Energy, a 64.4% cut to Wind Energy, a 56.8% cut to Water Power, and a 52.7% cut to Geothermal Technologies. Under the Energy Efficiency

³ <https://www.energy.gov/cfo/downloads/fy-2021-budget-justification>

program, funding for Advanced Manufacturing and Building Technologies would decrease by 67.6% and 67%, respectively. Nuclear Energy would also be cut by 21% (or \$313 million) and Fossil Energy R&D would be cut by 2.5% (or \$19 million).

In addition, the Administration is proposing to cut the Office of Science by \$1.16 billion, or 16.6%, from FY20 enacted levels. The Office of Science is responsible for stewarding ten national laboratories and a portfolio of major scientific user facilities that provide unique capabilities to carry out research conducted by thousands of users from industry and academic institutions across the country. Within the Office of Science, the Administration proposes cutting Fusion Energy Sciences by 36.6% (\$246 million), Biological and Environmental Research by 31.1% (\$233 million), High Energy Physics by 21.7% (\$227 million), Basic Energy Sciences by 12.5% (\$227 million), and Nuclear Physics by 8.4% (\$60 million). The request also proposes a marginal increase for Advanced Scientific Computing and Research of 0.8% (\$8 million). Construction for the ITER international fusion project within the Fusion Energy Sciences program would receive a 58.4% cut, and construction for the Long Baseline Neutrino Facility within the High Energy Physics Program would receive a 47.8% cut. If enacted, these levels would put funding for these projects well below what DOE itself determined would be required to keep them both on schedule and minimize their total project costs. The Office of Science would also receive a major 42.2% (\$126.9 million) cut to its Science Laboratories Infrastructure account.

The Office of Electricity (OE) and the Office of Cybersecurity, Energy Security, and Emergency Response would both receive proposed budget increases of 2.6% (\$5 million) and 18.6% (\$29 million), respectively. Within the Office of Electricity, the Administration proposes providing \$2 million to a new Defense Critical Energy Infrastructure program to advance technologies that ensure critical infrastructure possesses reliable, resilient energy systems.

Within the Administration's topline request for DOE R&D, it allocates \$190 million across EERE, OE, and the Office of Science to support an Energy Storage Grand Challenge to advance next-generation energy storage technologies.

National Science Foundation (NSF)

NSF Spending⁴
(dollars in millions)

	FY19 Actual	FY20 Enacted	FY21 Request	Change FY21 - FY20	
				Amount	Percent
National Science Foundation	8,150.2	8,278.3	7,741.4	-536.9	-6.5%
Research & Related Activities	6,578.1	6,737.2	6,213.0	-524.2	-7.8%
Education & Human Resources	934.5	940.0	930.9	-9.1	-1.0%
Major Research Equipment & Facilities Construction	285.3	243.2	229.8	-13.5	-5.5%
Agency Operations & Award Management	332.7	336.9	345.6	8.7	2.6%
National Science Board	4.3	4.5	4.2	-0.3	-6.4%
Office of Inspector General	15.3	16.5	17.9	1.4	8.2%

The Administration's proposal includes \$7.74 billion for the National Science Foundation, a decrease of \$536.93 million from the FY20 appropriated level of \$8.28 billion. The proposal includes a large increase for certain areas of science and technologies the Administration describes as having the potential to drive "industries of the future" and significant cuts to investments in all other areas of research, STEM education, and broadening participation activities.

The proposal includes a \$403 million (87%) increase for investments in artificial intelligence (AI) and a \$120 million (113%) increase for quantum science, while funding for advanced manufacturing is essentially flat. Funding for implementing the 10 Big Ideas is also increased, with Quantum Leap (\$26 million or 44% increase), Mid-Scale Research Infrastructure (\$38 million or 63% increase), and Convergence Accelerator (\$29 million or 69% increase) getting the biggest boost.⁵

Most of the proposed budget cut comes from the Research and Related Activities (R&RA) account, which is reduced by \$524 million (8%) compared with FY20. All but one of the research directorates has a proposed cut. The geosciences (GEO) directorate, which supports research related to climate change, is cut the most (\$133 million or 14% reduction), while the budgets for the two directorates that support research in artificial intelligence and quantum science are largely spared. The computer and information science and engineering (CISE) directorate is increased (\$77 million or 8%) and the mathematical and physical sciences (MPS) directorate is only slightly decreased (\$42 million or 3%).⁶

⁴ <https://www.nsf.gov/about/budget/fy2021/index.jsp>

⁵ Since funding levels for AI and quantum activities and the Big Ideas are not specified in the FY20 appropriations, we compare with FY 19 spending levels.

⁶ Since funding at the directorate or division level is not specified in the FY20 appropriations, we compare the proposal for R&RA directorates and EHR divisions to agency spending in FY19.

One key focus for the proposed investments in AI is funding for up to six National AI Research Institutes (up to \$20.0 million each over five years) “that will serve as national hubs for universities, federal agencies, industry, and nonprofits to advance AI research and workforce development in key areas while addressing grand challenges.”⁷ Investments in quantum science will support up to three additional Quantum Leap Challenge Institutes (up to \$25 million each over five years). The proposal also includes \$17 million for a new Spectrum Innovation Initiative with the goal to “promote dynamic and agile electromagnetic spectrum utilization.”⁸ This funding would support piloting, testing, and rolling out National Radio Dynamic Zones⁹ and standing up a National Center for Wireless Spectrum Research.

Programs in the broadening participation portfolio are cut by a combined \$180 million (15%) compared with FY20. The program with the biggest proposed cut is the Hispanic serving institution (HSI) program, a decrease from \$45 million to \$14 million (68%) compared with FY20 appropriations. The HBCU Undergraduate Program and the HBCU Excellence in Research programs are cut by 11 and 47%, respectively. The INCLUDES and ADVANCE programs are each cut by 5% and the Tribal Colleges and Universities Program (TCUP) is cut by 17%. The Established Program to Stimulate Competitive Research (EPSCoR) program is also cut by \$26 million (14%).

The Education and Human Resources (EHR account) is cut by \$9 million (1%). While the topline EHR budget is held essentially flat, the proposal funnels money out of the Division of Undergraduate Research (\$28 million decrease) and into the Division of Graduate Research (\$28 million increase).¹⁰ The request includes a \$9 million (3%) cut to the Graduate Research Fellowship which would result in 300 fewer fellowships being awarded. The Robert Noyce Teacher Scholarship program is cut by \$22 million (34%) and the Advanced Technological Education (ATE) is cut by \$4 million (5%). Finally, spending on education activities across the R&RA directorates is decreased by \$58 million (36%).

Construction is fully funded for the three ongoing major research facility projects – the Antarctic Infrastructure Modernization for Science (AIMS), the High Luminosity-Large Hadron Collider (HL-LHC) Upgrade, and the Vera C. Rubin Observatory (formerly the Large Synoptic Survey Telescope-LSST). The budget includes no funding for the design of next generation multi-user research facility projects.

⁷ <https://www.nsf.gov/about/budget/fy2021/index.jsp>

⁸ Ibid

⁹ Innovative approaches to dynamic spectrum sharing in specialized geographic regions.

¹⁰ Ibid.

National Oceanic and Atmospheric Administration (NOAA)¹¹

The Administration's budget proposal includes a total discretionary budget¹² of \$4.6 billion for the NOAA, a decrease of \$728 million from the FY20 enacted total discretionary appropriation of \$5.4 billion. Major cuts are proposed to ocean science and research, climate research and climate services, education and grant programs, the National Weather Service workforce, and laboratories and Cooperative Institutes funding, whereas investments in mapping the EEZ, commercial weather data programs, and the GOES-R and Space Weather programs are increased. Overall, despite modest increases to some programs, there are cuts proposed to every line office.

Most of the proposed cuts come from the Office of Oceanic and Atmospheric Research (OAR), which is reduced by \$238 million (40%) compared with FY20. Within OAR, the largest cuts are to the Climate Research program, with the proposed elimination of Climate Competitive Research, compared to the \$63 million enacted for this program in FY20. The request also proposes to eliminate OAR's National Sea Grant College program, funded at \$87 million in FY20, and significantly cuts the budgets for laboratories and Cooperative Institutes across OAR. The budgets for the Climate Research program, the Weather & Air Chemistry Research program, and the Ocean, Coastal, and Great Lakes Research program, have proposed reductions of \$13.5 million (20%), \$16.8 million (17.5%) and \$7.2 million (16.6%) respectively compared with FY20 enacted levels.

The proposed budget for the National Ocean Service (NOS) is reduced by \$225 million (37%) compared with FY20. Within NOS, there are major cuts to coastal science and management, specifically, competitive research through the Coastal Science and Assessment program is eliminated, compared with \$19 million enacted in FY20, and coastal management grants under the Ocean and Coastal Management and Services program are also eliminated, compared with \$77 million in FY20.

The National Weather Service (NWS) is reduced by \$48 million (4%) compared with FY20. The proposed cuts reduce funding for its Analyze, Forecast and Support workforce by \$15 million (2.9%) compared with FY20. Other cuts include a \$9 million (0.6%) reduction to the National Environmental Satellite, Data, and Information Service (NESDIS) compared to FY20, a \$10 million (3%) reduction to the Office of Marine and Aviation Operations (OMAO) compared to FY20, and a \$29.1 million (96%) reduction of the budget of the Office of Education within the Mission Support office compared with FY20.

¹¹ As of February 24, 2020, NOAA has not published their Congressional Justification for FY21. This charter is based on preliminary budget request tables.

¹² Total discretionary budget includes discretionary ORF, PAC, and other discretionary appropriations, but does not include direct obligations or mandatory accounts.

Department of Homeland Security (DHS)*DHS R&D Spending¹³*
(dollars in millions)

	FY19 Actual	FY20 Enacted	FY21 Request	Change FY21 - FY20	
				Amount	Percent
Department of Homeland Security					
Science & Technology Directorate	819.8	737.3	643.7	-93.6	-12.7%
Countering WMD Office	434.9	432.3	377.2	-55.1	-12.7%
U.S. Fire Administration	44.2	46.8	49.7	2.9	6.2%
Assistance to Firefighter Grants (AFG)	350.0	355.0	344.3	-10.7	-3.0%
Staffing for Adequate Fire and Emergency Response (SAFER) Grants	350.0	355.0	344.3	-10.7	-3.0%

Science and Technology Directorate

The President's Budget Request proposes \$643.7 million for the DHS Science and Technology (S&T) Directorate, \$93.6 million (12.7%) below the FY20 enacted level. These cuts include an \$82 million overall decrease to the Research and Development account. The R&D cuts include \$22 million from chemical, biological, and explosive R&D and \$5.5 million from cybersecurity and information analysis R&D. Further, the request decreases funding for university programs from \$40.5 million in FY20 to \$21.7 million for FY21 and eliminates five of the 10 university-based centers of excellence.

Countering Weapons of Mass Destruction (CWMD)

The Office of Countering Weapons of Mass Destruction carries out the core functions of the former Domestic Nuclear Detection Office (DNDO) and the Office of Health Affairs (OHA). The request proposes to fund CWMD at \$377.2 million, \$55.1 million (12.7%) below FY20 funding of \$432.3 million. The decrease in funding includes a \$6 million cut to Federal assistance to local communities which helps them prepare and build capacity in detecting, identifying, responding to, and mitigating nuclear, chemical, radiological, and biological threats and incidents. The decrease also cuts \$11 million from R&D, including technical forensics and detection capability development. The proposed R&D funding for FY21 is \$25 million below (30%) FY19 funding.

Federal Emergency Management Administration: U.S. Fire Administration; Fire Grants

The request proposes to fund the U.S. Fire Administration at \$49.7 million for FY21, a 6% increase above the FY20 funding level of \$46.8 million.

¹³ <https://www.dhs.gov/publication/congressional-budget-justification-fy-2021>

FEMA administers two fire grants programs: the Assistance to Firefighters Grants (AFG), which provides funding to local fire departments to purchase firefighting and emergency response training and equipment, and the Staffing for Adequate Fire and Emergency Response program (SAFER), which provides local fire departments funding for the hiring, recruitment, and retention of firefighters. The Administration proposes \$344 million for each AFG and SAFER, a 10 million cut in funding below the FY20 funding level of \$355 million for each program.

Department of Commerce

National Institute of Standards Technology

NIST Spending¹⁴
(dollars in millions)

	FY19 Actual	FY20 Enacted	FY21 Request	Change FY21 - FY20	
				Amount	Percent
National Institute of Standards and Technology	985.5	1,034.0	717.9	-316.1	-30.6%
Scientific and Technical Research and Services	724.5	754.0	652.0	-102.0	-13.5%
Industrial Technology Services	155.0	162.0	25.3	-136.7	-84.4%
Manufacturing Extension Partnership	140.0	146.0	0.0	-146.0	-100.0%
Manufacturing USA	15.0	16.0	25.3	9.3	58.1%
Construction of Research Facilities	106.0	118.0	40.6	-77.4	-65.6%

The FY21 request for NIST is \$718 million, a decrease of \$316 million or 31% from the FY20 enacted level. Of this, Scientific and Technical Research Services—NIST’s core measurement research and standards account—would be cut by \$102 million, or 14%. While the Administration claims it plans to increase funding for “industries of the future,” at NIST at least, it primarily focuses on artificial intelligence. The budget proposal would increase measurement tools and testbeds for AI technologies by \$25 million, while cutting funding for other important information technology challenges, including voting technologies and smart grid interoperability. Moreover, the administration proposes a 30% cut for advanced manufacturing and material measurement, a 6% cut to biosciences, and a 13.5% cut to quantum science and measurement dissemination. Some areas receive small increases, such as cybersecurity and privacy, which combined receive a 2.5% increase. The proposal significantly cuts funding for forensics and greenhouse gas emission estimation. Finally, the proposal calls for a 7% decrease in funding for neutron scattering research.

The Industrial Technology Services Account, which includes the Manufacturing Extension Partnership (MEP) program and the Manufacturing USA institutes, is cut by \$137 million or 85%. This cut reflects the Administration’s proposal, once again, to eliminate all support for the MEP program. The MEP program has proven to be a successful model for federal-state partnerships with significant payoff in economic growth and job creation across our Nation.

¹⁴ https://www.commerce.gov/sites/default/files/2020-02/fy2021_nist_ntis_congressional_budget_justification.pdf

According to NIST, for every dollar of Federal investment, the MEP National Network generates \$29 in new sales growth for manufacturers and \$31 in new client investment. However, the budget request does provide \$25 million (a 60% increase) to continue to support NIST's current Manufacturing USA institute in Delaware and to competitively award a second institute.

The budget request also cuts NIST's construction budget by \$77 million, or 66%. The request covers only some basic maintenance of NIST facilities but falls well short of what is necessary to meet construction needs. Because many of NIST's buildings have not been remodeled since the 1960s, decaying infrastructure has limited staffs' ability to pursue research, reduced the accuracy of standards, and harmed staff morale. In lieu of direct funding, the budget proposes legislation, the Federal Capital Revolving Fund Act of 2021, which would fund large-dollar, federally owned capital projects using special rules.

*Economic Development Administration (EDA)*¹⁵

The Administration once again proposes to close the Economic Development Administration, thus eliminating all programs under the agency, including the Regional Innovation Program (RIP) created by the *America Competes Act of 2010* and reauthorized for an additional 5 years in December 2019. Appropriators funded RIP at \$33 million in FY20.

*Office of Space Commerce*¹⁶

In the FY21 budget request for the Department of Commerce, the Administration is proposing—as it did in its FY20 request—a reorganization and expansion of the Department's commercial space activities as part of its response to the President's issuance of Space Policy Directive-3 in 2018. The FY21 request again proposes combining two offices currently under the National Oceanic and Atmospheric Administration (NOAA), the Office of Space Commerce and the Commercial Remote Sensing Regulatory Affairs (CRSRA) Office, into a single Office of Space Commerce that would fall directly under the Secretary of Commerce. In FY20, Congress maintained the CRSRA Office and the Office of Space Commerce under NOAA and appropriated \$1.8 million and \$2.3 million, respectively, to the offices. In FY21, the Administration is requesting \$15 million for the proposed expansion of the Office of Space Commerce, which is \$10.9 million above—or more than triple—that of the combined FY20 appropriation for the CRSRA Office and the Office of Space Commerce.

In addition to continuing ongoing commercial space activities of the Department of Commerce, the FY21 budget proposal would also support Administration priorities for streamlining commercial space regulations and significantly improving data and capabilities for space situational awareness (SSA) and space traffic management (STM). The proposed increase in funding for FY21 would provide for additional staff, especially for SSA technical and policy staff; developing technical prototypes for SSA; promoting partnerships with industry toward

¹⁵ https://www.commerce.gov/sites/default/files/2020-02/fy2021_eda_congressional_budget_justification.pdf

¹⁶ https://www.commerce.gov/sites/default/files/2020-02/fy2021_dm_congressional_budget_justification.pdf

improved SSA/STM operations, including notification and warnings systems; and beginning development of an open architecture data repository for dissemination of SSA data from a variety of sources to the growing, diverse civil space user community.

Environmental Protection Agency (EPA)

EPA R&D Spending¹⁷
(dollars in millions)

	FY19 Actual	FY20 Enacted	FY21 Request	Change FY21 - FY20	
				Amount	Percent
Environmental Protection Agency S&T	695.1	716.4	484.7	-231.7	-32.3%
Office of Research and Development (ORD)	474.3	497.2	296.5	-200.7	-40.4%

The President's Budget for FY21 requests \$6.7 billion for the Environmental Protection Agency (EPA), \$2.4 billion (26%) below the FY20 enacted level of \$9.1 billion. The request for the Science & Technology programs within the EPA is \$485 million, which is \$232 million (32%) below the FY20 enacted level of \$716 million. There are modest budget increases in multiple research program areas to deal with PFAS, lead, and harmful algal blooms. The budget for the Office of Research and Development (ORD), has been proposed to be cut by approximately \$201 million (40%) from the FY20 enacted appropriations across five of the six integrated and transdisciplinary research programs.

Cross-cutting reductions include the elimination of the Agency's only extramural research grant program, the Science to Achieve Results (STAR) Grants, on the order of at least \$28.6 million, to prioritize intramural research. There are also significant cuts to intramural research within the agency in this budget request. This budget proposes to eliminate all climate change research within the Air and Energy Research Program, which saw the most drastic cut in the President's Budget falling 65% from \$94.5 million in the FY20 enacted appropriations to \$33.5 million in the FY21 request.

The Sustainable Communities Research Program is cut by nearly 56% to \$58.6 million which includes eliminating work related to the Ecotox database and the EPA's Report on the Environment. The Health and Environmental Risk Assessment Research Program, which is responsible for the Integrated Risk Information System (IRIS) program, the development of the Integrated Science Assessments (ISAs) which are utilized to set the National Ambient Air Quality Standards (NAAQS), and supporting the requirements of the new *Toxic Substances Control Act* (TSCA) is cut by 35% from the FY20 enacted levels to \$24.7 million. The Safe and Sustainable Water Resources Research Program was cut 29% to \$78.9 million, and the Chemical Safety and Sustainability Program was cut 25% to \$67 million. The Homeland Security Research Program saw a modest budget increase of \$0.69 million (2%) over the FY20 enacted levels to \$33.8 million. This budget request also proposes to reduce the total number of FTE

¹⁷ <https://www.epa.gov/sites/production/files/2020-02/documents/fy-2021-congressional-justification-all-tabs.pdf>

across the agency from an estimated 14,172 in the FY20 enacted appropriations to 12,610. This includes a reduction of 482.7 FTE within the Science and Technology program alone.

Department of Transportation

DOT R&D Spending¹⁸ (dollars in millions)

	FY19 Actual	FY20 Enacted	FY21 Request	Change FY21 - FY20	
				Amount	Percent
Department of Transportation R&D					
Office of the Asst Sec for Research & Technology	8.5	21.0	11.0	-10.0	-47.6%
Federal Highway Administration R&D***	420.0	420.0			
Nat'l Highway Traffic Safety Administration R&D	356.1	366.3	317.0	-49.3	-13.5%
Federal Rail Administration R&D	40.6	40.6	41.0	0.4	1.0%
Federal Transit Administration R&D	28.0	28.0	8.0	-20.0	-71.4%
Federal Aviation Administration¹⁹	17,451.9	17,617.7	17,521.5	-96.2	-0.5%
Research, Engineering, and Development	191.1	192.7	170.0	-22.7	-11.8%
AST Operations	24.9	26.0	27.6	1.5	5.8%

FAA Research, Engineering and Development

The Administration's FY21 budget request proposes \$170 million for the FAA Research, Engineering and Development program (RE&D), which is a \$22.67 million (12%) decrease from the FY20 appropriation. The RE&D account funds research, engineering and development to improve the safety, efficiency, and environmental impact of the national airspace system. The FY21 request includes \$5.8 million for research on the safe integration of commercial space operations into the national airspace, a \$3.3 million (130%) increase from the FY20 appropriation; \$10.2 million for aeromedical research, which is a \$2.3 million (29%) increase from the FY20 appropriation; and \$24 million, the same level as in the FY20 appropriation, for Unmanned Aircraft Systems (UAS) safety research into new operational concepts and technologies and to support the new regulatory standards. Other safety-related research areas supported in this budget request include \$1 million for advanced materials, a \$13.7 million (93%) decrease from the FY20 appropriation; \$6.4 million for aircraft icing, a \$2.6 million (29%) decrease from the FY20 appropriation; and \$9.6 million for continued airworthiness, which is a \$0.6 million (6%) decrease from the FY20 appropriation. The FY21 RE&D budget request also includes \$40.5 million in activities supporting the FAA's ongoing modernization aviation effort, the Next Generation Air Transportation System (NextGen) a \$3.1 million (8%) decrease from the FY20 appropriation. The RE&D programs directly supporting NextGen in FY21 are Wake Turbulence, Air Ground Integration Human Factors, Weather Technology in the

¹⁸ <https://www.transportation.gov/mission/budget/fiscal-year-2021-budget-estimates>

¹⁹ <https://www.transportation.gov/mission/budget/aa-cj-fy-2021-estimates>

Cockpit, Flight Deck Data Exchange Requirements, and Environmental Research Aircraft Technologies and Fuels.

FAA Office of Commercial Space Transportation

The Administration's FY21 budget request proposes \$27.6 million for the FAA Office of Commercial Space Transportation (AST), \$1.5 million (6%) above the FY20 appropriation. AST licenses and monitors the safety of commercial space launches and reentries, as well as commercial spaceports. The FY21 request includes a \$685,000 increase to support six additional operational staff and three additional mission support staff to meet the growing demand for AST products and services and to support the safe and efficient integration of space launch and reentry into the national airspace. The request would also support AST's ongoing effort to update the commercial space transportation launch and re-entry licensing process, with a goal of creating a performance-based, single license regime for all types of launch and re-entry vehicle operations.

Surface Transportation Funding

The Administration proposes \$11 million in funding, a \$2 million increase (22%) over the FY20 funding level, for research coordination activities of the Office of the Assistance Secretary for Research and Technology (OST-R). While OST-R received \$21 million in FY20, that funding included \$12 million for additional activities, including new Tier 1 University Transportation Centers, a transportation emergency planning data model, a transportation resilience metrics study, and a center of excellence on automated systems. Funding for FY18 and FY19 was \$8.5 million.

The Federal Highway Administration (FHWA) receives funding for research activities through the Highway Trust Fund (HTF). The allocations for these activities are authorized by Congress under the *FAST Act*, the surface transportation law. The *FAST Act* authorized funding from FY15 through FY20, and the Administration's budget requests have funded FHWA research in accordance with the *FAST Act*. In FY20, the *FAST Act* authorized \$420 million for FHWA research activities. The FY21 budget request does not include funding levels for research at FHWA. The DOT budget justification states "in the coming months the Administration will submit a comprehensive surface transportation reauthorization proposal to Congress."

The Federal Transit Administration (FTA) also receives HTF funds. In FY20, FTA received \$28 million for transit research. The Administration proposes \$8 million to fund these activities, a \$20 million decrease (71%).

The request also cuts National Highway Traffic Safety Administration's (NHTSA) research programs by 13.5% overall. Vehicle safety programs were cut from \$194 million in FY20 to \$156 million proposed in the FY21 budget. This cut includes a \$15 million decrease for vehicle

safety research and analysis. However, highway safety R&D funding increases from \$155 million in FY20 to \$161 million proposed for FY21.

In addition, the request proposes to flat fund the Federal Railroad Administration research programs at \$41 million. Rail research includes funding for reducing derailments due to track related and rolling stock related issues, reducing train collision due to train control and communications, reducing accidents caused by human error, and reducing overall system safety issues.

Chairwoman JOHNSON. This hearing will come to order. And without objection, the Chair is authorized to declare a recess at any time.

Good morning, and welcome to today's hearing to review the President's Fiscal Year 2021 budget request for research and development (R&D). Dr. Droegemeier, I want to welcome you before this Committee for the first time in your role as Director of the Office of Science and Technology Policy (OSTP).

And this is not news to you that I'm disturbed, although not surprised, to see such a disappointing vision for the future of the United States' science and engineering enterprise, as is laid out in the budget proposal. In the press release announcing the release of this budget, the Administration claimed that this proposal represents a 6 percent increase for R&D. This is a creative use of math that has not fooled us. This budget proposal is only 6 percent better than last year's even-worse proposal. And, fortunately, Congress rejected last year's proposal and appropriated for R&D increases. So in truth, this Fiscal Year 2021 budget proposal represents a 9 percent cut to R&D funding.

At the National Science Foundation (NSF), large increases for artificial intelligence (AI) and quantum science, which of course I support, are more than offset by cuts to all the other areas of research, to STEM (science, technology, engineering and mathematics) education, and to broadening participation, resulting in a 6.5 percent overall cut. While the proposal for NASA (National Aeronautics and Space Administration) at first blush appears to be a strong request, it amounts to a significant increase for human space exploration in large part at the expense of investments in research, high-quality science missions, and STEM education.

At the Department of Energy (DOE), the Administration proposes to cut non-defense R&D programs by \$4.5 billion. Once again, we see a proposal to eliminate the ARPA-E (Advanced Research Projects Agency—Energy) program, even though ARPA-E is praised across the political spectrum for its success.

Finally, the proposal includes severe cuts to atmospheric and ocean research at NOAA (National Oceanic and Atmospheric Administration), which will help to inform our approach to climate change mitigation, and guts EPA (Environmental Protection Agency) assessment programs which help ensure Americans have access to clean air and water.

While there are a few bright spots in this proposal, this request represents a disturbing and ill-advised disregard for the pressing issues facing this country and the urgent need for science and engineering solutions to help us address them. Fortunately, Congress will once again have the last word. I just wish we didn't have to engage in this dangerous game each year. It sends a message to our international competitors and our own young students and researchers that we are not serious about maintaining our leadership in science and technology (S&T).

And finally, while the hearing is about the budget request, we also need to discuss the larger environment for science under this Administration. While the cuts are ostensibly proposed in the name of budget austerity, in reality they appear to be driven by an ideology that aggressively seeks to undermine faith in science and sci-

entists, and to discount expertise at all levels of government and society.

There have been some very high-profile cases of agency scientists and research managers being silenced by reassigning them to offices and jobs unrelated to their expertise. The U.S. Department of Agriculture (USDA) research and data services are being gutted. The State Department is ignoring advice from CDC (Centers for Disease Control and Prevention) scientists, putting Americans' lives at risk. The President himself tried to undermine the critical mission of NOAA to keep Americans safe during severe weather. And sadly, those cases making the news are just the tip of the iceberg. The silencing of experts is happening quietly across the Government on a daily basis.

I welcome your testimony this morning, but I do not imagine that anyone will walk away from this hearing satisfied. While I believe you are personally committed to a thriving scientific enterprise, the budget proposal before us, and the actions taken to undercut the Federal scientific workforce, are not worthy of this great Nation.

I look forward to us working together.

[The prepared statement of Chairwoman Johnson follows:]

Good morning and welcome to today's hearing to review the President's Fiscal Year 2021 budget request for research and development. Dr. Droege-meier, I want to welcome you before our Committee for the first time in your role as Director of the Office of Science and Technology Policy.

That said, I am disturbed, although not surprised, to see such a disappointing vision for the future of the United States science and engineering enterprise as is laid out in this budget proposal.

In the press release announcing the release of this budget, the Administration claimed that this proposal represents a 6 percent increase for R&D. That is a creative use of math that has fooled no one. This budget proposal is only 6 percent better than last year's even worse proposal. Fortunately, Congress rejected last year's proposal and appropriated increases for R&D. So in truth, this Fiscal Year 2021 budget proposal represents a 9 percent cut to R&D funding.

At the National Science Foundation, large increases for artificial intelligence and quantum science, which of course I support, are more than offset by cuts to all other areas of research, to STEM education, and to broadening participation, resulting in a 6.5 percent overall cut.

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Finally, Dr. Droege-meier, while this hearing is about the budget request, we also need to discuss the larger environment for science under this Administration. While the cuts are ostensibly proposed in the name of budget austerity, in reality they appear to be driven by an ideology that aggressively seeks to undermine faith in

science and scientists and to discount expertise at all levels of government and society.

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Dr. Droegemeier, I welcome your testimony this morning, but I do not imagine that anyone will walk away from this hearing satisfied. While I believe you are personally committed to a thriving scientific enterprise, the budget proposal before us, and the actions taken to undercut the federal scientific workforce, are not worthy of this great Nation.

Chairwoman JOHNSON. I now recognize Mr. Lucas, our Ranking Member.

Mr. LUCAS. Thank you, Chairwoman Johnson, for holding today's hearing. Good morning, and welcome, Dr. Droegemeier. It's always nice to have both a friend and a fellow Oklahoman before the Committee.

Under Dr. Droegemeier's leadership, the White House Office of Science and Technology Policy has undertaken major efforts to advance our Nation's leadership in the industries of the future. At the same time, OSTP is taking action to ensure the research environment in the United States is safe, secure, and welcoming to the brightest minds and ideas.

I'm looking forward to hearing about updates on the great progress OSTP is making on our Committee's research priorities, including standing up the National Quantum Institute, advancing a national artificial intelligence agency, developing clean energy solutions, and promoting the bioeconomy.

I also appreciate the opportunity to hear about progress being made on other issues important to the Committee, from protecting American research from foreign influence to addressing sexual harassment in science.

I commend the Administration for establishing the Joint Committee on the Research Environment (JCORE) to tackle these and other issues affecting the American scientific enterprise. This new interagency committee demonstrates a commitment to ensure that the American scientific enterprise remains a model for the world.

The President's Fiscal Year 2021 budget request includes bold proposals for ensuring American leadership in priority areas, including artificial intelligence, quantum information science, and space exploration. The request proposes a doubling of funding for AI and quantum over the next two years and sets us on course to return astronauts to the Moon by 2024.

These investments are in line with legislation that I introduced last month to double basic research over the next 10 years and invest in R&D for the industries of the future that will keep America competitive.

This Committee has a long, bipartisan record of support for funding fundamental research and development. Our challenge in Congress is to set funding priorities that ensure America remains a leader in science and technology, while also balancing the government's budget.

I very respectfully remind my colleagues on both sides of the aisle that the President's proposal is just the start of the budget process. Ultimately, Congress decides how the government will be funded.

Unfortunately, for the second year in a row it appears the majority in the U.S. House will fail to produce a budget. It's imperative that we work together in a bipartisan, bicameral fashion to advance a budget that funds our Nation's priorities while acknowledging our very real fiscal challenges.

I know that Dr. Droegemeier believes, as I do, that American superiority in science and technology is fundamental to our economic competitiveness, our national security, and our way of life. I appreciate your commitment to advancing science in America, and I'm looking forward to your testimony today.

And with that, Madam Chair, I yield back.

[The prepared statement of Mr. Lucas follows:]

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I appreciate your commitment to advancing science in America and I'm looking forward to your testimony today.

I yield back.

Chairwoman JOHNSON. Thank you, Mr. Lucas.

If there are members who wish to submit additional opening statements, your statements will be added to the record at this point.

At this time I'd like to introduce our witness. Our witness today is Dr. Kelvin Droegemeier. He is the Director of the White House Office of Science and Technology Policy or OSTP. And as Director of OSTP, he serves as the President's science advisor and leads OSTP in its coordination of science and technology initiatives across the Federal Government.

Before joining the White House, he served as Vice President of Research and Regents Professor of Meteorology at the University of Oklahoma. He served two 6-year terms on the National Science Board having been nominated by President George W. Bush and President Barack Obama.

As our witness should know, you will have 5 minutes for your spoken testimony. Your written testimony will be included in the record for the hearing. And when you have completed your spoken testimony, we will begin the round of questions. Every member will have 5 minutes to question the witness.

So now I will ask Dr. Droegemeier to make his statement.

**TESTIMONY OF DR. KELVIN DROEGEMEIER,
DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY**

Dr. DROEGEMEIER. Thank you so much, Chairwoman Johnson. Good morning to you and good morning to Ranking Member Lucas and Members of the Committee. It is my great privilege to be with you today to discuss the President's budget for science and technology research and development in Fiscal Year 2021.

You know, I've had the privilege of working with this Committee for many years, and I really deeply appreciate your support for science, your bipartisan support.

In this month's State of the Union address President Trump declared—he said, we are pioneers who look at tomorrow and see unlimited frontiers just waiting to be explored. You know, this reminded me of the words written by Vannevar Bush, who was President Roosevelt's de facto science advisor. In 1945, 75 years ago, Dr. Bush wrote, and I quote, "The pioneer spirit is still vigorous within this Nation. Science offers a largely unexplored hinterland for the pioneer who has the tools for the task. The rewards of such exploration both for the Nation and the individual are great," unquote.

You know, these words ushered in the modern research enterprise that we have today, and now, 75 years later, America is the unquestioned global leader in science technology. The Federal Government, the private sector, academia, and nonprofit organizations are all working together to leverage massive R&D investments, about \$580 billion in 2018—I believe it's over \$600 billion today—to capitalize on talents from every ZIP Code across America and from every country around the globe. And the purpose is to build the greatest discovery engine and innovation engine in the history of the world right here in America. And, as Dr. Bush predicted, the rewards indeed have been very great.

Now, although America is the S&T leader today, undisputed, continued leadership is absolutely not guaranteed. In fact, as the coronavirus threat illustrates, the importance of our leadership,

American S&T leadership, is only going to grow more pronounced in the decades to come.

The Fiscal Year 2021 budget demonstrates the Trump Administration's commitment to American S&T leadership by investing \$142.2 billion in Federal R&D. This does represent a significant 6 percent increase compared to the President's Fiscal Year 2020 budget last year.

The President's budget prioritizes the critical industries of the future, which are—and I think you heard these a lot—artificial intelligence, quantum information science, 5G and advanced communications, biotechnology, and advanced manufacturing. These industries promise to open new frontiers in advanced computing and sensing and computation, advanced medical diagnostics. They promise to create high-paying jobs and also to transform the way that we as Americans communicate, travel, and also stay secure.

Now, AI and quantum in particular hold tremendous potential as they intersect basically with every field of science and technology. The budget, as you know, includes major increases in quantum and nondefense AI research and development spending as part of the President's commitment to double the nondefense investment in these areas by fiscal 2022. The budget also includes investments that will equip more Americans with the skills necessary to support and advance AI and quantum, as well as the tens of millions of other jobs that require STEM know-how.

Beyond these particular investments, the budget focuses on achieving sustainable deep exploration beginning with returning to the moon as a launchpad for the mission to Mars. Research and partnerships in ocean science and technology also are an Administration priority, and the budget advances systematic ocean mapping and research so that our Nation can both better understand as well as utilize our vast ocean resources.

The Administration also recognizes—and I really want to underscore this point—that leadership not only requires strategic R&D investments but also, as Ranking Member Lucas mentioned, research environments that reflect our American values. To that end, nearly 10 months ago I launched the National Science and Technology Council's Joint Committee on the Research Environment or JCORE. JCORE is doing something quite unique. It's taking a whole-of-nation approach to develop policy recommendations and other suggested actions on four interrelated topics: first, strengthening the security of the American research enterprise; second, creating safe and inclusive research environments; third, reducing administrative workload on our federally funded researchers; and finally, improving rigor, integrity, and reproducibility in research.

I wanted to specifically mention our research security efforts, as I know this topic is of particular interest to many of you. The JCORE Subcommittee on Research Security is engaging every sector of our scientific community to protect our research enterprise while also ensuring the openness that it needs to thrive.

During the past several months, I have personally met with institutional leaders and faculty and students visiting several universities across the country to discuss these issues. And I've also met with allies abroad who are responding to similar challenges. We're also working very, very closely with your colleagues in Congress,

which has shown very strong bipartisan support for JCORE. I especially want to thank you, Chairwoman Johnson and Ranking Member Lucas and others of you on the Committee, for engaging with OSTP on this very important set of issues.

In conclusion, the Nation's R&D investments and policies must reflect and address urgent opportunities and challenges confronting us and also make use of every asset at our disposal. Federal investment is only one part of a much larger enterprise that unites, inspires, and rallies people from every organization from multiple sectors to a single common cause, and that is to improve the health, security, and prosperity of our great Nation. These are indeed times of unlimited exploration potential, new frontiers waiting to be explored, and the President's budget, in concert with other actions that I have mentioned and I'm sure we'll discuss, ensures that America will continue to lead the way.

Thank you so very much, and I look forward to your questions.
[The prepared statement of Dr. Droegemeier follows:]



Dr. Kelvin Droegemeier
Director, Office of Science and Technology Policy
Executive Office of the President of the United States

Before the
Committee on Science, Space, and Technology
United States House of Representatives

on
“The President’s FY 2021 Budget Request for Research & Development”

February 27, 2020

Chairwoman Johnson, Ranking Member Lucas, and Members of the Committee, it is a privilege to be here with you today to discuss the President’s Budget for science and technology (S&T) research and development (R&D) in Fiscal Year (FY) 2021.

In his State of the Union Address, President Trump declared that “We are pioneers” who “look at tomorrow and see unlimited frontiers just waiting to be explored.” Hearing these words, I was reminded of the words written in 1945 by Vannevar Bush, President Roosevelt’s *de-facto* science advisor. Dr. Bush wrote: “The pioneer spirit is still vigorous within this nation. Science offers a largely unexplored hinterland for the pioneer who has the tools for his task. The rewards of such exploration both for the Nation and the individual are great.”

Since Dr. Bush, the architect of America’s post-World War II research framework, wrote these words in his treatise, *Science—The Endless Frontier*, America has experienced nearly uninterrupted growth in combined public, private, academic, and nonprofit research and development investment. Our Nation has created educational and training pathways into STEM for hard working, creative, and entrepreneurial Americans from every zip code, and we’ve attracted the best and brightest from every country. We have built the best discovery and innovation engine in history on bedrock American values, such as free inquiry, competition, and inclusion. And as Dr. Bush predicted, the rewards indeed have been great for our Nation and the world.

The Multisector American S&T Enterprise

Seventy five years later, America is the unquestioned global leader in S&T. The foundation of our success is the ability of the Federal government, private sector, academia, and nonprofits to not only make substantial investments in R&D—an estimated total of \$580 billion in 2018¹—but also work in mutually complementary ways to discover, innovate, educate, and train. The Federal government serves as a catalyst for innovation by investing in early stage basic and applied research, particularly in areas where little or no commercial incentive exists. The Federal government also facilitates discovery and innovation by removing barriers, streamlining processes, and avoiding the creation of unnecessary regulatory hurdles.

American academic institutions, which include many of the world’s best research universities, performed an estimated \$74.7 billion in R&D in 2018, including 48 percent of all U.S. basic research.² Between 1996 and 2017, academic R&D led to over 13,000 start-ups (with 6,518 operational as of 2018), more than 200 drugs and vaccines, 420,000 invention disclosures, and 100,000 U.S. patents, contributing \$865 billion to the U.S. gross domestic product (GDP) and an astounding \$1.7 trillion in gross industrial output.³ Additionally, R&D performed at our Nation’s colleges and universities helps prepare the next generation of researchers, technicians, engineers, and millions of other STEM-capable workers who together are building America’s future.

The private sector leverages the discoveries and talent resulting from Federal and academic investments to fuel its own massive R&D capacity. As of 2018, businesses were responsible for funding over two-thirds of U.S. R&D, including nearly 29 percent of all U.S. basic research⁴. The industries that perform the vast majority of private sector R&D, such as the aircraft, pharmaceutical, motor vehicle, IT services, and computer products industries, together account for 11 percent (\$2.3 trillion) of U.S. GDP, employ nearly 10 million workers, and produce many of the innovations transforming our lives.⁵ For example, in October 2019, researchers from Google reportedly demonstrated, for the first time, that a quantum computer could perform a calculation impossible for a standard computer (quantum supremacy). This breakthrough has the potential to accelerate advancements in security, health, and many other areas and was made possible through collaborations with NASA Ames Research Center, Oak Ridge National Laboratory, and international researchers and built on the results of federally-funded research.

Nonprofits funded an estimated \$22.7 billion in R&D in 2018, which represents the third highest level of funding behind the private sector and Federal government and slightly more than the \$21.1 billion funded by colleges and universities themselves. Non-federal government R&D spending contributed another \$4.7 billion to the U.S. total.⁶

¹ National Science Foundation, National Center for Science and Engineering Statistics 2019. National Patterns of R&D Resources: 2017–18 Data Update. NSF 20-307. Alexandria, VA. Available at <https://ncses.nsf.gov/pubs/nsf20307>

² National Science Foundation, National Center for Science and Engineering Statistics 2019. National Patterns of R&D Resources: 2017–18 Data Update. NSF 20-307. Alexandria, VA. Available at <https://ncses.nsf.gov/pubs/nsf20307>

³ https://autm.net/AUTM/media/Surveys-Tools/Documents/AUTM_FY2018_Infographic.pdf

⁴ National Science Foundation, National Center for Science and Engineering Statistics 2019. National Patterns of R&D Resources: 2017–18 Data Update. NSF 20-307. Alexandria, VA. Available at <https://ncses.nsf.gov/pubs/nsf20307>

⁵ National Science Board, National Science Foundation. 2020. Production and Trade of Knowledge- and Technology-Intensive Industries. Science and Engineering Indicators 2020. NSB-2020-5. Alexandria, VA. Available at <https://ncses.nsf.gov/pubs/nsb20205/>

⁶ National Science Foundation, National Center for Science and Engineering Statistics 2019. National Patterns of R&D Resources: 2017–18 Data Update. NSF 20-307. Alexandria, VA. Available at <https://ncses.nsf.gov/pubs/nsf20307>

Although America is the global S&T leader, continued leadership is far from guaranteed. Extraordinary opportunities and profound challenges confront our country daily. From defending against threats to American economic and national security, to promoting international R&D collaborations, to ensuring that Americans are prepared to navigate the impact of technology both at home and in the workplace, our global S&T leadership will only become more important in an unpredictable future. This is why the Administration has prioritized substantially increasing the ability of the four sectors of our S&T enterprise to coordinate, collaborate, and partner to leverage resources and share expertise, data, and infrastructure *well beyond* that of the past and present.

The President's FY 2021 Budget

R&D represents the seed corn of innovation, and thus of our economic prosperity, quality of life, and national security. Most of the technologies we enjoy today—from streaming online services to wayfinding apps to medical diagnostics and treatment—trace their roots to R&D. The Trump administration recognizes the actions our Nation takes now in laying a strong foundation for R&D will pave the road ahead, and we are committed to taking the wise and necessary steps to ensure that America remains the world leader in S&T research and education for generations to come. The FY 2021 Budget reflects this commitment by investing \$142.2 billion in Federal R&D. This represents a 6 percent increase compared to the President's FY 2020 Budget and a 20 percent increase from the President's FY 2019 Budget.

The FY 2021 Budget demonstrates responsible leadership by prioritizing areas with the most potential to benefit all Americans, combined with thoughtful reallocations in lower-priority areas. It does this by focusing on the basic and applied research, as well as experimental development, that fuel critical Industries of the Future (IoF)—artificial intelligence (AI), quantum information science (QIS), 5G/advanced communications, biotechnology, and advanced manufacturing. These industries, which rely on basic research discoveries, promise to open new frontiers in sensing and computation, promote health through advances in medical diagnostics, create high-paying jobs and entirely new industries, transform the way Americans communicate and travel, and keep the Nation and its people safe and prosperous.

AI and QIS, in particular, hold enormous potential as they intersect with nearly every field of science, technology, and health and can act as innovation force multipliers. As such, the FY 2021 Budget includes major increases in QIS and non-defense AI R&D as part of a commitment to double Federal investment in these areas by 2022. For example:

- The FY 2021 Budget brings spending for AI R&D and interdisciplinary research institutes at the National Science Foundation (NSF) to more than \$830 million. This represents a more than 70 percent increase over the President's FY 2020 Budget.
- NSF investment in QIS research will double to \$210 million.
- The Department of Energy's (DOE) Office of Science will invest \$125 million in AI research, a \$54 million increase over the FY 2020 Budget.
- DOE Office of Science spending on QIS research will increase to \$237 million, which will boost QIS efforts at the National Laboratories and in academia and industry. The Budget also includes \$25 million to support early stage research for a quantum internet.

- The Budget includes an additional \$100 million for the Department of Agriculture's Agriculture and Food Research Initiative (AFRI) to support AI, promote advanced manufacturing in the food and agricultural sciences, and continue efforts in robotics and application of big data that are required to advance precision agriculture.
- The Budget provides a \$25M increase for AI focused work at NIST, effectively doubling their current investment.
- The Budget allocates \$50 million for new research at the National Institutes of Health on chronic diseases using AI and related approaches.

The President's commitment to double AI and QIS R&D by 2022 punctuates a three year effort that include the enactment of bipartisan legislation, the creation of national strategies, and presidential actions and initiatives. For example, under President Trump, the United States launched the U.S. national strategy for AI leadership—the American AI Initiative—by Executive Order, proposed the first-ever AI regulatory guidance for the use of AI in the private sector, and worked with Congress to pass the National Quantum Initiative Act.

The Budget also includes critical investments in education and job training that will equip more Americans with the skills necessary to support and advance AI and QIS. For example, at NSF an additional \$50 million will go toward workforce development in these two areas, with a focus on community colleges, Historically Black Colleges and Universities (HBCUs), and minority serving institutions (MSIs). Also, to bolster the STEM academic pathways aligned with the local business community and improve public-private partnerships, the Budget for the Department of Education requests \$150 million for the Minority Science and Engineering Improvement Program to fund STEM activities led by HBCUs and MSIs located in Opportunity Zones.

Beyond these investments in AI, QIS, and other IoTF areas, the President's FY 2021 Budget directs R&D efforts to achieve sustainable human exploration in deep space, beginning with returning to the lunar surface where we will develop the skills, systems, and operational experience to enable human missions to Mars. The Budget provides robust funding for the National Aeronautics and Space Administration (NASA) programs, including \$3.4 billion for the development of lander systems, over \$700 million to support lunar surface activities, and \$233 million for robotic precursor missions to Mars that would also conduct cutting-edge science.

Research and partnerships in ocean S&T remain an Administration priority. The FY 2021 Budget advances coordinated and systematic ocean mapping and research so that our Nation can start to better understand the vast resources in our oceans. To support these activities, the Budget increases National Oceanic and Atmospheric Administration's funding by over 10 percent for its participation in the National Oceanographic Partnership Program and increases funding by more than 60 percent for regional data portals that provide public access to maps and information about the ocean environment.

Leveraging the Full Capabilities of America's S&T Enterprise – Research Environments

The Trump Administration recognizes that continued global leadership requires not only strategic R&D investments, but also that research environments reflect American values. This means research environments that are safe, inclusive, operate with maximum integrity, appropriately

balance openness and international collaboration with security, and make efficient use of taxpayer dollars by not encumbering researchers, agencies, or institutions with unnecessary administrative work. U.S. policies and practices must evolve thoughtfully and appropriately to meet current and future challenges.

That is why nearly ten months ago I launched the National Science and Technology Council (NSTC) Joint Committee on the Research Environment (JCORE). JCORE is taking an integrative, whole-of-government approach to develop policy recommendations on four interrelated topics:

- Strengthening the security of American research enterprise;
- Creating safe and inclusive research environments;
- Reducing administrative burdens on Federally-funded research; and
- Improving rigor and integrity in research.

I will focus on the first two in my testimony.

To maintain our global leadership, America must *balance protecting* its research enterprise while *promoting* the openness that has been and will continue to be critical to our success. America's S&T enterprise attracts, educates, and trains some of the world's most creative, innovative, and determined students and researchers, which has led to significant discoveries and innovations. Many countries recognize our success and are imitating us by building their own innovation capacity by making significant investments in R&D and higher education. For those that share America's values, we celebrate their participation in a global S&T enterprise, as this creates new knowledge and new opportunities for international collaborations and partnerships.

Unfortunately, some countries have sought S&T progress through illicit means, including unapproved transfer or outright theft of American research, ideas, and intellectual capital. In particular, the government of the People's Republic of China (PRC) continues to steal technology and surreptitiously influence research in the United States for their own economic and military gains. Some U.S.-based researchers also have violated longstanding conflict of interest rules by failing to disclose foreign financing, affiliations, companies, and IP – often at the behest of the PRC government. These actions undermine the integrity of our research enterprise not to mention pose risks to our economic and national security. Universities will need to better protect academic and research program integrity, key interests of the United States, by providing full transparency regarding foreign funding, as current law requires, through their semiannual reporting.

The JCORE Subcommittee on Research Security is the primary mechanism for Federal agencies to share and coordinate different policies and practices to strengthen the security of America's research enterprise. The Subcommittee aims to protect America's research enterprise without comprising our values or weakening America's long-standing competitive advantages, such as the open and collaborative nature of our system or our ability to attract the best talent from around the globe. The Research Security Subcommittee brings together over 20 Federal departments and agencies, including R&D funding agencies, the Departments of State and Education, the law enforcement and intelligence communities, and National Security Council staff.

The Subcommittee is focused on four areas:

- Appropriate and effective risk management;
- Consistent, coordinated, and effective outreach to and engagement with academic and research institutions, at home and abroad;
- Developing guidance to Federal agencies; and
- Developing best practices for academic and research institutions.

America's continued S&T leadership depends not only on balancing security and openness but also creating research environments that are safe and inclusive. There have been numerous reports detailing the persistence of harassment and its detrimental consequences. A 2018 National Academies report, *Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine*, found that 20 to 50 percent of female students and greater than 50 percent of female faculty and staff experienced sexually harassing behavior in academia. This is unacceptable. Harassment can silence or limit career opportunities for both victims and bystanders, resulting in a costly loss of talent, squandered resources, and the erosion of public trust.

To address this issue, the Office of Science and Technology Policy (OSTP) created the JCORE Subcommittee on Safe and Inclusive Research Environments. Sixteen departments and agencies across Government are collaborating to address the conditions that generate harassment and bias within research environments. The Subcommittee is completing a comprehensive inventory of all Federal agencies' policies and practices targeted at addressing harassment *of all forms* in the research environment. Through this policy inventory, the Subcommittee will identify best practices, which will eventually lead to a Coordinated Federal Action Plan. This plan will present a Government-wide approach to addressing harassment in the research environment.

In President Trump, our innovators have a champion in the White House who will fiercely defend their interests and the American research system at the foundation of our success. Through JCORE, we are protecting the Nation's research enterprise, leading globally with our principles and American values, and empowering our citizens to more fully participate in and benefit from innovations in science and technology.

Leveraging the Full Capabilities of America's S&T Enterprise – Partnerships

Federal investments in R&D are critical, but the real power of American S&T enterprise is that it leverages the combined investments, infrastructure, and creative talent of government, industry, academia, and nonprofit organizations in interdependent and mutually complementary ways. Partnerships create the connective tissue between these sectors and serve as force multipliers, enabling partnering organizations to achieve higher returns on investment, reduce unnecessary duplication, create efficiencies, leverage assets, and advance their respective missions. The August 2019 Memorandum on the Administration's FY 2021 R&D Budget Priorities encouraged agencies to "build, strengthen, and expand strategic multisector partnerships," including partnerships that build S&T capacity at institutions seeking to do so, such as R2 ("high research activity") institutions and HBCUs; support research infrastructure; and improve transfer of federally-funded technologies from "lab-to-market."

To advance this goal, the President's Council of Advisors on Science and Technology (PCAST) is currently exploring ways to engage industry, academia, and the DOE National Labs collaboratively to further national priorities, such as advancing the Industries of the Future and creating a diverse, highly skilled workforce. During the first ever official meeting between PCAST and the National Science Board (NSB) on February 4, 2020, the collective group identified the need to strengthen and leverage multisector partnerships as a key to unlocking the full innovation capacity of our S&T enterprise, and they agreed to work collaboratively on this topic.

Additionally, on February 10, 2020, OSTP established an NSTC Fast Track Action Committee (FTAC) on Partnerships. The FTAC will include representation from across the entire Federal government, not just agencies involved in R&D activities, and has been charged with identifying within 90 days actions that will improve the ability of departments and agencies to partner with each other and non-federal entities on S&T research, development, and education.

Leveraging the Full Capabilities of America's S&T Enterprise – People

The American people have been and will continue to be our Nation's greatest resource. The Trump Administration recognizes this and has made building the workforce of the future a central priority. In December 2018, the Administration released a 5-year strategic plan for STEM education, *Charting A Course For Success: America's Strategy for STEM Education*. The plan identified three goals:

1. Build Strong Foundations for STEM Literacy by ensuring that every American has the opportunity to master basic STEM concepts and to become digitally literate.
2. Increase Diversity, Equity, and Inclusion in STEM and provide all Americans with lifelong access to high-quality STEM education, especially those historically underserved and underrepresented in STEM fields and employment.
3. Prepare the STEM Workforce for the Future—both college-educated STEM practitioners and those working in skilled trades that do not require a four-year degree—by creating authentic learning experiences that encourage and prepare learners to pursue STEM careers.

Federal departments and agencies are continuing to implement the goals of the strategic plan and, in October 2019, OSTP released a report detailing their progress. Although the Federal government plays a key role in STEM, preparing *all* Americans with the knowledge and skills necessary to adapt and thrive in a constantly evolving workforce demands a multisector approach. To engage the private sector, one example includes the President's National Council for the American Worker, which has asked companies and trade groups throughout the country to sign the *Pledge to America's Workers*—a commitment to expand programs that educate, train, and reskill workers from high-school age to near-retirement. To date, more than 400 companies and organizations have signed the Pledge to deliver nearly 15 million career and training opportunities to American workers. Likewise, the PCAST Subcommittee on Meeting National Needs for STEM Education and a Diverse, Multi-Sector Workforce is collaborating with the NSB to address this topic. These and other actions will ensure that as S&T transform every aspect of our lives, no American is left behind.

S&T Highlights during the Trump Administration

Each year, America's scientists and engineers make new discoveries and create innovations that justify the confidence placed by the public in the research enterprise for 75 years. Just this past year, numerous Federal agencies joined the Event Horizon Telescope—an international collaboration that captivated the world with the first-ever image of a black hole. Previously thought to be impossible, this achievement demonstrates the type of discovery that strong partnerships can achieve.

Under the Trump Administration, our researchers and medical professionals are making great strides in health. For the first time, we eliminated the DNA of the virus responsible for AIDS from the genomes of living animals. We are now producing reliable and reproducible amounts of Actinium-225, a previously scarce alpha emitter thought to be one of the most potentially effective treatments for metastasized cancers because of its capacity to target malignant cells while leaving healthy tissue unharmed. Through the President's Roadmap to Empower Veterans and End a National Tragedy of Suicide (PREVENTS), researchers are using AI and machine learning technologies to more accurately and swiftly identify veterans at risk of suicide.

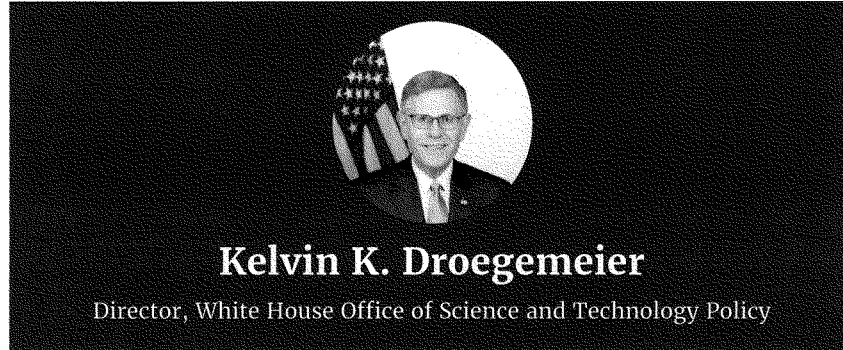
This Administration continues to recognize the importance of oceans to the U.S. economy, national security, and environment. We are continuing to implement President Trump's 2018 Executive Order on Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States. In November 2019, the President signed a Memorandum directing the Ocean Policy Committee to coordinate the development of a national strategy for mapping, exploring, and characterizing the U.S. Exclusive Economic Zone and the shoreline and nearshore of Alaska. New and emerging ocean science and technologies, developed and deployed in partnership with the ocean S&T community, will play a critical role by allowing us to more efficiently explore and understand the ocean at a level of detail and at a geographic scale never before possible. This knowledge will significantly advance the conservation, management, and balanced use of our Nation's oceans to the benefit of all Americans.

We are continuously improving our scientific abilities, such as providing high quality elevation data nationwide by 2025 to find our natural water storage through advanced U.S. Geological Survey maps, and improving natural disaster preparations like we did in October 2019 with the first-ever statewide public testing of earthquake early warning systems. From new applications to combat transnational human smuggling such as the Department of Homeland Security's Igloo Program to the National Institute of Standards and Technology's use of blockchain technology in providing tamper-proof transmission of manufacturing data, our S&T enterprise is protecting America's people and institutions from emerging and intensifying threats.

This past summer, we celebrated our budding research workforce by awarding 314 early-career professionals with the Presidential Early Career Award for Scientists and Engineers (PECASE). In October, I welcomed 215 teachers and 15 mentors to the White House and awarded them with the Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST) and the Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM). These leaders in research and STEM are the heirs of the legacy forged by the great American pioneers and trailblazers of yesteryear, and we will continue to recognize their accomplishments.

We will be highlighting these and other achievements in the annual S&T Highlights document now in preparation and scheduled for release in early March.

In conclusion, I believe the Nation's R&D investments, strategies, and policies must reflect and address the urgent opportunities and challenges confronting the Nation and make use of every tool, asset, and competitive advantage at our disposal. Federally-funded R&D remains an essential building block for discovery, innovation, and education. But Federal investment is only one part of a much larger enterprise that unites, inspires, and rallies people and organizations from every sector to a common cause—to improve the health, security, and prosperity of the Nation. There indeed are “unlimited frontiers waiting to be explored” and the President's FY 2021 Budget in concert with the other actions I have summarized ensure that America continues to lead the way.



As Director of The White House Office of Science and Technology Policy (OSTP), Dr. Kelvin K. Droegemeier serves as President Donald J. Trump's science advisor and leads OSTP in its coordination of science and technology initiatives across the Federal Government. Kelvin's background is in extreme weather, numerical weather prediction, and data assimilation.

Before joining The White House, Kelvin served as Vice President for Research and Regents' Professor of Meteorology at the University of Oklahoma, where he joined the faculty in 1985 as Assistant Professor of Meteorology. In his 33 years at the University of Oklahoma, Kelvin generated more than \$40 million in research funding and authored or co-authored more than 80 refereed articles and 200 conference publications. He also co-founded, directed, and led the National Science Foundation (NSF) Science and Technology Center for Analysis and Prediction of Storms (CAPS) and served as co-founder and Deputy Director of the NSF Engineering Research Center for Collaborative Adaptive Sense of the Atmosphere (CASA).

Kelvin served two six-year terms on the National Science Board, the governing body of the NSF, including the last four years as Vice-Chairman, having been nominated by Presidents George W. Bush and Barack Obama and twice confirmed by the United States Senate. He has also served on and chaired numerous national boards and committees and is a Fellow of the American Meteorological Society and American Association for the Advancement of Science. He was appointed in 2017 as Oklahoma Cabinet Secretary of Science and Technology.

Born in Kansas, Kelvin earned a B.S. in meteorology from the University of Oklahoma and M.S. and Ph.D. degrees in atmospheric science from the University of Illinois at Urbana-Champaign.

Chairwoman JOHNSON. Thank you very much. We will now start our first round of questions.

Dr. Droegemeier, in reference to climate change, you have frequently said more research on the topic is needed. While the existence of and human role in climate change are already clear, we welcome further research in the detailed dynamics about climate and how it is changing. However, this Administration has proposed to cut the Department of Energy's Atmospheric System Research program in the Office of Science by 54 percent and the Environmental System Science program by 69 percent.

Similarly, climate change research is eliminated at EPA with the Air and Energy Research program being cut by 65 percent and NOAA's research office being cut by 40 percent. Why are you proposing massive cuts to climate science when you admit yourself that it is a topic that needs more research to expand our understanding? Does that not strike you as contradictory or illogical?

Dr. DROEGEMEIER. Well, thank you for that very good question. And, as you say, we know the broad contours of the impact of greenhouse gases. We know that they are increasing. We know that there is a relationship with that and the increase of surface temperature. We don't need really super sophisticated models to tell us that. In fact, the very simple models, simple theories tell us that.

What we don't know are, for example, how that really has local and regional impacts, the rate of the warming, a lot of the details. And so a climate scientist will tell you that, you know, we really need better fidelity. The way that we are operating our models today is not sufficient to provide the scientific guidance that's really needed to address the challenges that you mention, especially the local and regional challenges.

If you look at the U.S. Global Change Research program budget, it's been about \$2.2, \$2.4 billion a year for the past several years. This is in—depending on constant dollars or current dollars, however you look at it. So the investments have been pretty robust. And I think the real focus now is to take our assets and really demonstrate a focus on how do we get to higher spatial resolution, which is something that DOE is doing through the acquisition of major new computers. That's one of the big limitations of our models is that we are running them at resolutions that cannot capture the details of clouds and precipitation, high-level clouds, the hydrologic cycle. The physics are there in the models, but we actually have to sort of run them at very coarse resolutions, which mean we don't really take advantage of the physics.

So the investment in high-speed computation or high-capacity computing is really important, so a lot of the work that's been done in building the models is already an investment that's a sunk cost. Now we really need to utilize them and run them on these faster machines. And I think if we do that along with some other changes and, you know, improvements of physics using real data and things like that, we will work to eliminate the biases in the model and the drifts and things which are actually quite large. But that doesn't mean that it discounts what we already know about the warming of the surface temperatures globally, so we really need to do that to advance the climate science.

Chairwoman JOHNSON. Thank you very much. I know that you are aware that in order to keep pace, we've got to make sure that we have the professional people available and skilled to do it, so I was really very disappointed to see that the President's budget proposal includes significant cuts to STEM education and broadening participation activities. At NSF the STEM education activities funded out of the research and related activities account are cut by 36 percent.

The Robert Noyce Teachers' Scholarship program is cut by 1/3, and the HBCU (Historically Black Colleges and Universities) Excellence in Research program is cut in half. The Hispanic-Serving Institutions program is cut by nearly 70 percent, and the Tribal Colleges and University program is cut by 17 percent. At DOE the Workforce Development for Teachers and Students program is cut by 27 percent. And, once again, the President calls for the elimination of NASA's Office of STEM Engagement.

I simply cannot understand the rationale behind the budget proposal that includes these large increases for technologies to drive industries of the future with huge cuts to programs that would help educate and train people to work in these industries. Can you help us understand why we have such large cuts critical to STEM education and why these cuts align with the STEM Education Strategic Plan of the OSTP published at the end of 2018?

Dr. DROEGEMEIER. Right. Thank you for that. So you mentioned the STEM plan. I think it's really an extraordinarily good plan. It's got three pillars, STEM-literate society, increasing STEM workforce, and the third one is broadening participation. As a STEM educator myself, somebody who's worked very hard and is passionate about STEM education, I think it really has the opportunity to move the needle.

The U.S. Government spends about \$2.9 billion a year across about 160-some STEM programs. There's a lot of wonderful flowers blooming out there. We also have nonprofits, for-profit companies investing very, very heavily in STEM. What we are trying to do through this plan is create a national alignment, a direction of where we're going as a nation, and it started by bringing about 200 people to Washington from every State, about two or three people from every State and territory, brought them to Washington, talked about where we want to go. They're teachers, superintendents, principals, parents, so on, where do we want to go and how do we align ourselves with that?

So when you look at these programs, you realize that there are a lot of STEM programs out there, but they're not coordinating with one another. We don't get this economy of scale. There's a bunch of things happening, but we're not coordinating effectively. And that's one of the things that plan has done and is doing. And in fact we just released the year 1 annual report for that, and we have a matrix that describes how we're doing, and we're sort of holding ourselves to that report card.

The point about the NASA office, NASA will continue to engage a lot of STEM programs. That office is extremely important, but actually NASA activities and, you know, what NASA does is actually used by many, many groups and inspires students to come into STEM fields and so on. So NASA is focusing its STEM activities

on things directly related to its mission directorates. It's not giving up on STEM at all. It's really focusing on the things that are specifically related to its missions and partnering with NSF, with non-profits, and with other organizations to take all of the wonderful resources and assets that NASA has and make them available to build these other programs. The Challenger Center is a great example of that.

So I think, you know, you think about NASA overall, it really is sort of a big STEM program in and of itself, and it's quite inspirational but also provides tremendous resources so that other programs can thrive and grow. So I think this is really a focusing, a bringing together of disparate STEM programs into a much more critical mass and really continuing to leverage this nearly \$3 billion-a-year investment.

Chairwoman JOHNSON. Thank you very much.

Dr. DROEGEMEIER. Thank you.

Chairwoman JOHNSON. Mr. Lucas.

Mr. LUCAS. Thank you, Madam Chair.

Doctor, our Committee has been very focused on ensuring the security of our research enterprise and addressing foreign influence while also ensuring that we maintain the open science enterprise that's made us the world's leader in science and technology. Could you elaborate on how OSTP is implementing the *Securing America's Science and Technology Act* and what other actions you're taking to address this threat?

Dr. DROEGEMEIER. Yes, sir. Thank you, Ranking Member Lucas. For those of you—I think you're all familiar with it but maybe folks in the audience, this act tasks OSTP with creating an interagency working group to do exactly what the Ranking Member mentioned and also work with the National Academies to stand up a set of roundtables to basically have conversations about addressing these important issues.

So, as I mentioned in my opening statement, back May 6 actually, almost 10 months ago, we started this thing called the Joint Committee on the Research Environment, one of the main dimensions of which is the issue of research security. So the key here is balancing the openness of our research enterprise, which is so important for our success today but also going forward with the fact that we are in a different environment today with countries, in particular China, that really did not hide their intentions about undermining our research enterprise. Taking unfair advantage, creating unlevel playing fields, and so on.

So the key here is to make sure that we put in place policies that focus on addressing those issues while not unduly tying our own hands or increasing the administrative workload so high that we now have researchers instead of spending 44 percent of their time on administrative activities, they're spending 60 or 70 percent of their time.

I can tell you that universities are taking a lot of actions on this. We are developing policy mechanisms. We actually have some policies drafted right now. They're in a very good spot. A year ago I'm not sure I could have said that, but I think they've gotten to a very good spot of providing the appropriate balance between protecting and promoting our research enterprise. We're going to be rolling

those things out. We're also working on best practices to universities, which are taking a lot of action, as I say, on their own, and also helping educate the community about what the threats are and what the challenges are.

Personally, I see this as a great way to lean forward with American values because, you know, at the end of the day when you do research—Dr. Foster knows this very well. When you do research, you sign up to behave ethically, to have an openness, to share, to treat people with respect. And folks that come here a lot of times from other countries, that's not the environment they grew up in, but that's American values. That's who we are as Americans. But it's also who we are as a research enterprise.

So it's a great opportunity for us to shine a bright light on what integrity looks like, what playing by the rules looks like, and it doesn't matter if you're from Oklahoma like Mr. Lucas and I are or if you're from some other country. If you come here, you need to play by the rules. And if you don't, if you intentionally break the rules, once you understand them and are taught the rules, you don't belong in our research enterprise, and we don't want you here because that means you're not following the rules of integrity that the taxpayers depend on us to follow. So we're very, very serious about this, and we've been going—we've been meeting twice a week for 10 months on this. We're driving the agenda very hard.

And I really appreciate your support on this. Members of Congress have been extremely supportive. You've put several bills on the table. I think the bill that the Ranking Member mentioned is a very thoughtful bill, and we're moving aggressively forward, and also engaging the National Academies.

Mr. LUCAS. Following along with the discussion that the Chair entered into on STEM education, I think you know, Doctor, I introduced the *Rural STEM Education Act* last fall, which is intended to address the many challenges rural schools face in providing quality STEM education. Could you please share how the Administration's 5-year strategic plan for STEM education will improve engagement in underserved communities, including rural students like Oklahoma?

Dr. DROEGEMEIER. Absolutely. It's a great question. And that second pillar of the STEM Education Strategic Plan, which again was put in place as a whole-of-nation approach, bringing everybody to the table so that when it was issued people in local school districts and rural areas could say, you know, I see myself in that. I see how I could engage with that.

So one of the ways we do that is that pillar of broadening participation. That doesn't just mean, you know, race and gender and things like that. It means also rural, every ZIP Code in America. So one of the ways that we're doing that is engaging through things like apprenticeships. You know, STEM education isn't just degrees. It's apprenticeships. It's 2-year degrees. It's technical colleges, schools that give you a skilled technical workforce, which is very, very important, especially for rural areas.

So we're working very much on that, also bringing broadband to rural areas, that's very important for education, for STEM skills, learning online, and things like that, so the American Broadband Initiative, of which OSTP is a part, the work that the FCC (Federal

Communications Commission) is doing to put out the \$20 billion in the—I think it's called the Connect America Initiative and other initiatives where they're taking money from the auctions to build connectivity to rural America. And this is a huge priority for the President, really help empower education in the rural communities. So it's really, really important that we do that, that no part of America gets left behind.

The challenges we face in science and technology are great. The opportunities are great. We have to have everybody at the table, anybody who wants to participate has to be able to do that, and we're very committed to that.

Mr. LUCAS. Doctor, I hope that one of my colleagues in a little bit will ask the question about satellite data and 5G and weather forecasting. I'm out of time, but I'd like to hear from you about that—

Dr. DROEGEMEIER. Sure.

Mr. LUCAS [continuing]. Shortly. Thank you.

Dr. DROEGEMEIER. You bet. Thank you.

Mr. LUCAS. I yield back.

Chairwoman JOHNSON. Thank you very much. Ms. Lofgren.

Ms. LOFGREN. Thank you very much, Doctor. I, like the Chairwoman, I have many questions about the budget, but I'll limit myself to two. The first has to do with the fusion energy project ITER (International Thermonuclear Experimental Reactor). As you're aware, there were problems, a management problem a number of years ago. Dr. Bigot came in by all accounts and straightened them out, gotten the project back on track.

We have received—had received estimates for what our contribution should be really to minimize cost to the taxpayer but also to keep the project on track, and the requested budget for the last several years has not met those estimates. The Committee has been trying to get current estimates, and the Department of Energy actually refused to send them to us.

So I'm wondering if you, within the next week—since we have to make decisions on this, could you provide the Committee with updated estimates for the resources that are going to be required from the United States in the next fiscal year to maintain ITER's current schedule and to minimize its total project cost? Is that possible for you to do?

Dr. DROEGEMEIER. I will sure do everything I can to help. I will tell you I've worked very closely with the Department of Energy with Paul Dabbar, the Under Secretary, with Chris Fall, the head of the Office of Science, on ITER in particular, and we've looked at that project. And, you know, we're asking, OK, how do we move forward with it? It is a big, very expensive project, big goals, and so on, but we have commitments. We actually have treaty obligations with that project—

Ms. LOFGREN. Yes, we do.

Dr. DROEGEMEIER [continuing]. So we looked at that very carefully, and I'll be as helpful as I possibly can.

There are lots of interesting opportunities and other projects that are of smaller scale that look at fusion, that are pretty far along actually, but I think, you know, we have to be mindful of commitments we make to international partners, so—

Ms. LOFGREN. Well, that's an important commitment, but I support the entire fusion budget.

Dr. DROEGEMEIER. Right.

Ms. LOFGREN. There are important developments going on funded not only by the science budgets but by NNSA (National Nuclear Security Administration) and—but the payoff ultimately is so monumental—

Dr. DROEGEMEIER. Yes.

Ms. LOFGREN [continuing]. We should not falter in this quest.

Dr. DROEGEMEIER. I think fusion is the future, the long-term future. It's very, very bright, so yes. Thank you. I'll be happy to be helpful wherever I can. Thank you.

Ms. LOFGREN. Let me ask you this. An issue I've been interested in for many years is open access, public access to federally funded research papers. And, as you know, we have kind of a convoluted system. Obviously, everybody wants peer review, but it's run by private for-profit companies, and so the federally funded research really doesn't get available.

Now, we've made some progress, the 12-month rule. As you're aware I'm sure there were a lot of inquiries made in December from various scientific societies, publishers, stakeholders about the issue of public access. And last week, OSTP issued an RFI (request for information) on access to publications, data, and code. Now, publications I think is quite a different issue than the data and code question, and there's a very short timeframe. I'm wondering if it might be possible to extend the comment period at least to the publication issue because it is—I know what I think, but it is a complex issue, and I think that would help get the full flow of information in.

Dr. DROEGEMEIER. Sure.

Ms. LOFGREN. The other thing, I don't know if you can answer this yet, but is there consideration to change the 12-month period to make it a shorter time period?

Dr. DROEGEMEIER. So we have a subcommittee on Open Science within the National Science and Technology Council. It's been there for quite a while. And that's the mechanism by which we convene not only the interagency but the broader community. And we've had up to today about 100 or so meetings with various groups, publishers and researchers and so on. But you may know that recently we started holding roundtables, a little bit more visibility in terms of what we're doing, and the RFI absolutely to get the community's input.

It's an incredibly complicated landscape, as you absolutely are right in saying, and we want to make sure that since this is such an important aspect of the research enterprise and that we kind of broadly call it scholarly communications—you say data, publications, code, things like that—that we want to make sure that any changes that we might make or continuations are done with—in the most thoughtful way with the most information we could possibly have because this is foundational to our enterprise for intellectual property, for credit that faculty and other researchers get. So we're absolutely working together all of that information.

One thing I can tell you is that when you get different folks in the room, they learn a lot that they kind of thought they already

knew, and there were some surprises in these meetings. It was like, wow, I didn't realize that that's the way it worked, yet people seem to have entrenched positions. So I'm really pleased that people are open-minded about learning about this complicated enterprise. And I'm really personally committed to getting it right because, as a professor, this is truly important to me, but I know how important it is to research and to the world. So thank you for your support. Happy to keep you updated on that.

And extending the RFI, we do that a lot of times, and so my philosophy is if you go out for an RFI, you take a lot of time, people are putting time in doing it, so make sure we give enough time to get the thoughtful input. Let's not rush it. So we're certainly open to that.

Ms. LOFGREN. Thank you very much.

Dr. DROEGEMEIER. Sure.

Ms. LOFGREN. My time is expired, Madam Chairwoman.

Chairwoman JOHNSON. Thank you. Mr. Posey.

Mr. POSEY. Thank you very much, Madam Chair, for holding this hearing today. These are exciting times for space. It's exciting to have Jim Bridenstine as our NASA Administrator. We're thrilled to have Bob Cabana back to head up the Kennedy Space Center. Thank you for that. It's exciting to have a President that loves space. That's clear. And it's thrilling to have a Vice President who loves space and heads up the National Space Council and see that active again and moving forward. And it's especially great to see that space is still largely a bipartisan issue and probably the least daggers in this Committees of all the Committees in the House. And that's really a good thing.

Not many things were recommended for an increase like the NASA budget was, and we're all grateful to you for that. And pleased to see that you want to continue to make significant investments in our Nation's space program. Most of the increase will go toward the Artemis program, which is wonderful, and I think we're all excited about that.

But we do want to talk about some other objectives that are important, and that is ground support systems. We've always in the past received strong funding for ground support systems, and we'll work to continue to do that. You can have the best rockets and the best people on those rockets and the best people making those rockets—

Dr. DROEGEMEIER. Right.

Mr. POSEY [continuing]. But if you don't have the ground support systems in place, nobody goes anywhere. And we don't want to be on track for that. And it's a possibility we might be on that track, and we need to make necessary adjustments to that to make sure our ground support systems are going to actually help us go back to the moon and then ultimately to Mars.

In today's strong economy and the huge job demand, space, like most other industries, is a little bit in a bad spot for recruiting of skilled workforce people. So we often hear about the importance of internships and apprenticeships in STEM, which the Administration's 5-year plan also identified, and I'm just wondering if you'd speak to us about the steps the office is taking and the appropriate

Federal agencies are doing to support such activities, including those working in skilled trades who don't require a 4-year degree.

Dr. DROEGEMEIER. No, thank you for that. And you're spot on. One of the things that I talk about and I really increasingly am seeing in the country is what I call kind of a seamless STEM enterprise. And so, you know, sometimes research universities would look at a 2-year college and say, you know, well, kids that come to the university are not very well-trained, so we have to do a lot of remediation. We need to all work together. We need to all lift each other up.

And so, for example, I did a visit recently down to Virginia to a company that builds all the nuclear reactors and fuel and everything for our Navy submarines and ships. The people that were working on doing incredible things with welding and so on, none of them had a 4-year degree. They were all skilled tradespeople working with incredible computers.

So things like apprenticeships, programs like the National Council of the American Worker; the reskilling and upskilling of individuals who might be a traditional arc welder with an acetylene torch now will be running a computer. And you say, well, gee, is it going to displace that person? No, it's going to put them to a new level of economic earning because we still need their skills in operating that equipment because they're still welding at the end of the day. The robot is not doing it all on its own. There has to be somebody there guiding it along.

And so I think this is a tremendous opportunity with these industries of the future, AI and advanced manufacturing, 3-D printing, and things like that will really enable a lot of capabilities. So the apprenticeships programs, the skilled technical workforce, the National Council of the American Worker, the pledge to the American Worker that Ivanka is championing, upskilling and reskilling activities are really extraordinary.

And, you know, STEM is not just going to college and getting a STEM degree. It's the whole enterprise. And somebody who's getting, say, in the skilled technical job maybe goes to a 2-year school, maybe later on they get a 4-year degree, but if they don't, they can come out starting to make \$70–80,000 a year. That's a pretty good living. And so I think the President has been very, very clear and strong on this point of making sure that we don't disenfranchise those folks but we continue to support that type of activity because we need a whole spectrum of skills in this country.

Mr. POSEY. Well, I'm very pleased to hear you say that, and, you know, an economy where you have more job openings than you have people looking for work increases the economic value of every single person in the workforce. And of course we want to continue that.

Dr. DROEGEMEIER. Right.

Mr. POSEY. I see my time is expired, and I yield back, Madam Chair.

Dr. DROEGEMEIER. Could I just say one quick thing? You mentioned the ground systems. You look at big experiments like LIGO (Laser Interferometer Gravitational-Wave Observatory) and telescopes and stuff. People have to run those systems. They have to manage, maintain the HVAC (heating, ventilation, and air condi-

tioning) systems on things like that. A lot of those people don't have a degree, they don't need a degree, but you need their tremendous skills. And so those folks are just as important to science as the scientists actually doing the work. Sorry. Thanks.

Mr. POSEY. Thank you.

Chairwoman JOHNSON. Thank you very much. Mr. Lipinski.

Mr. LIPINSKI. Thank you. First question, very simple and easy, Doctor. How do you pronounce your last name?

Dr. DROEGEMEIER. I pronounce it Droegemeier. My parents pronounce it Drag Meyer, and nobody can ever spell it right that way, so—

Mr. LIPINSKI. All right. So, Dr. Droegemeier, I am—I've been very active on the issue of climate change for, you know, my entire 15 years here in Congress, and I think we're finally getting some—the concern has been raised so much that I think maybe we are going to make—potentially have some action soon. But I share the Chairwoman's concerns about the cuts in the research funding. I'm also concerned about the cuts to the Department of Energy's Energy Efficiency and Renewable Energy program and the ARPA-E program because I think those are programs that can help tremendously to advance us to new clean fuel sources, and I think that's critically important. Do you share my concern that climate change is something significant that we need to address?

Dr. DROEGEMEIER. Well, thank you, Mr. Lipinski. And I want to thank your staff for working with me several years ago before I came to the White House on a bill that you had dropped. I don't know if it ever went anywhere, but it was to look at IP (intellectual property) at universities and what buildings—so Sofya Leonova, who used to work for you, she was terrific, so thank you for that.

One of the things that we've highlighted in the OMB (Office of Management and Budget) OSTP yearly guidance memo on R&D priorities was predictability of the Earth system. And it's really important in terms of understanding climate projections, weather predictions, things like that, how predictable are these sorts of things? But, as I mentioned, you know, the sophisticated models that we have today are—the way we have to operate them is really well below the capabilities that are needed to guide decisions about coastal sea-level rise, things like that, or local changes in climate extreme events, and so on, so we really feel, No. 1, predictability is important but also providing the assets and resources we need to actually operate these models and do the socioeconomic scenarios that really drive climate change models. We don't really understand much about those. We're moving into a new era now with so-called SSPs (Shared Socioeconomic Pathways), which I think will be quite helpful, but we don't even assign a likelihood to any of those. So there's a lot of good work, and I think it could be enabled by artificial intelligence, for example.

I visited DOE not long ago and really looked at a lot of the good work they're doing in energy storage technology. They have a Coal FIRST program. They have an Energy Storage Grand Challenge. They're doing really amazing things. But what really struck me was what's happening in the private sector. There's a company that is now developed a capability to—

Mr. LIPINSKI. But wouldn't it be helpful with those programs that you said are great programs and I agree——

Dr. DROEGEMEIER. Yes.

Mr. LIPINSKI [continuing]. The private sector is also important, but you know, ARPA-E was created because there are things that the private sector will not invest in——

Dr. DROEGEMEIER. Right.

Mr. LIPINSKI [continuing]. That the public sector must. But let me—so I want to move on because it's sort of—and related to that, can you describe how the President's budget will support the development of Aurora and other similar supercomputer efforts? Because I think that fits in with what you're talking about here, Aurora at Argonne National Lab, which I represent.

Dr. DROEGEMEIER. Yes, absolutely. Aurora is a high priority. It's coming in, what, in a couple of years I believe, and then Frontier will replace the Summit system at Oak Ridge National Lab, and I think they're vying in a friendly competition between two national labs to see which one has the fastest computer.

But what is really important about that is that, you know, one of the issues with our climate models today, for example, is the fact that they extract about 4 to 5 percent of the peak theoretical performance of a computer. Back in the day when I was doing computing, it was 70 to 80 percent. And so what's nice about these new architectures is they have a lot of heterogeneity to them, different types of processors, so I think there's some promise there that we're going to actually be able to operate these models in the ways that we really need to operate them and with the level of sophistication that they already have to start addressing some of these questions and also address the issues of bias in the models and things like that, which continue to trouble us.

Mr. LIPINSKI. Yes. So is the Administration committed to the funding that's needed for Aurora?

Dr. DROEGEMEIER. I'd have to go look at the budget, Congressman, but I believe so. I mean, the last time I talked to the Director of Argonne and to Thomas Zacharia at Oak Ridge I believe those things were on track, but I could get back to you. I'd have to——

Mr. LIPINSKI. OK. Thank you.

Dr. DROEGEMEIER [continuing]. Look at that specifically.

Mr. LIPINSKI. One last very quick thing, the concern about—you talk about openness. There's been some talk about it. I have received a letter from a number of universities in the State of Illinois that have concerns about the denial of visas and other issues that have happened outside of the State Department and other processes that Customs and Border Patrol has been turning down visas, for example. And I just want your commitment to working with other parts of the Administration to make sure that, you know, as long as people are cleared to come here to study, to research, that they are not stopped at some other part by some other part of our Government.

Dr. DROEGEMEIER. Yes, sir. In fact, this JCORE Subcommittee on Research Security, we work with the State Department. In fact, these folks come to the meetings. They're part of a State Department, Homeland Security, FBI (Federal Bureau of Investigation),

National Security Agency. They're all involved at the table, and so we are looking at all of those issues, yes.

Mr. LIPINSKI. Yes, because, I just—I've heard that—and it's great what you have done with it, and I—but I've heard that there are problems that exist even after that process is completed. So if you would just look into that—

Dr. DROEGEMEIER. Absolutely.

Mr. LIPINSKI [continuing]. But I'm over my time.

Dr. DROEGEMEIER. You bet. Thank you, sir.

Chairwoman JOHNSON. Thank you very much. Mr. Babin.

Mr. BABIN. Yes, ma'am. Thank you very much, Madam Chair. And thank you, Dr. Droegemeier.

You mentioned briefly the need and importance of rural broadband. And as a representative of a rural district, I would agree wholeheartedly. I want to thank the President and the Administration for their commitment to connecting the entire country, including our rural communities, to the broadband and that issue. Could you elaborate on where we currently stand on this and the progress that we're making in terms of getting rural—I represent nine counties.

Dr. DROEGEMEIER. Right.

Mr. BABIN. Part of that's in Houston, certainly no problem there, but the upper—what we call deep east Texas, we—we're way behind. And it's something—

Dr. DROEGEMEIER. Right.

Mr. BABIN [continuing]. That really means a lot to me.

Dr. DROEGEMEIER. Sure.

Mr. BABIN. If you could elaborate on that.

Dr. DROEGEMEIER. Yes, sir. Absolutely. Thank you for that good question. A couple of dimensions to the answer. From an OSTP perspective, we're—we co-chair the American Broadband Initiative on behalf of the White House. Also, we're part of the Rural Prosperity Task Force, and so being from Oklahoma, I definitely—

Mr. BABIN. Absolutely.

Dr. DROEGEMEIER [continuing]. Resonate with your question. In the last C.R. (continuing resolution) there was a \$600 million of funding I think, as you all know, to USDA to do grants and bring other resources to bear on connecting rural America. The estimate that I've heard is about \$40 billion overall to do this. So to give that as a context, the Connect America Fund, which again is auction proceeds that the FCC has made available, they've done this in various ways. They've provided \$1.4 billion overall to connect a little over 600,000 homes and businesses. But the biggie right now is the Rural Digital Opportunity Fund. Again, the FCC provided \$20 billion over 10 years, so that kind of gets us halfway to this—to the completion.

And the other point here I would mention is part of the issue of connecting has to do with spectrum availability—

Mr. BABIN. Right.

Dr. DROEGEMEIER [continuing]. And that's something that we're working on within the White House. Larry Kudlow leads that as the National Economic Council Chair, a very important issue. And the Ranking Member mentioned with regards to whether we look at who's using the spectrum, can it be shared, can it be vacated,

all of those kinds of important issues. So that's part of the issue of making sure that it's available to rural broadband and also making the business case that's deploying in those areas where the populations are not as dense is still a very important one because of farming in rural communities are just a tremendous part of our economy——

Mr. BABIN. Sure.

Dr. DROEGEMEIER [continuing]. And a very important part of America. So we're making that case. I think the President is very, very strongly committed to that.

Mr. BABIN. Would you agree to work with me and my staff and give us maybe some pointers that——

Dr. DROEGEMEIER. You bet.

Mr. BABIN [continuing]. Some things that we might be able to do? I would appreciate.

Dr. DROEGEMEIER. Yes, sir. We can dive deeply——

Mr. BABIN. OK.

Dr. DROEGEMEIER [continuing]. Into that, you bet.

Mr. BABIN. Great. And the next question, China's investment and development and not on basic research implies that they're building their technological success on the basic research developed in the United States and other countries. We've even seen the infiltration of Chinese influence in our university systems on several different occasions at our top institutions here in just the last few weeks. We had a chemist that was arrested.

Dr. DROEGEMEIER. Right.

Mr. BABIN. How do we ensure that foreign nationals from China coming to study at our universities do not undermine our open system of research? And how seriously do you believe that university leaders are taking this threat?

Dr. DROEGEMEIER. That's a very, very good question. First of all, I would say from the data that we have China is really investing more in the applied—and I'm talking about the Chinese Government, let me be clear—investing more in the applied and the—sort of the experimental development, more the practical applied end, whereas we tend to invest Federal Government resources, I think very appropriately so, in the early stage research. So where is their basic research coming from?

Mr. BABIN. Yes.

Dr. DROEGEMEIER. The question is a little bit obvious there. They do invest in basic research.

I can tell you in meeting with university leaders all over the country, and my own university included, university leaders are taking this very, very seriously. And I think that's a development that has changed over time frankly. I think for a while it was, well, how real is this? And then you start to see these cases come up, University of Kansas, Emory, M.D. Anderson, Harvard. People realize, yes, this is real.

So what we're doing in JCORE is, again, really taking a behavior-based approach to this. And it really is about foreign government influence not just, you know, say, people coming here wanting to do bad things. There's strong influence on individuals in China in particular who come here and are under duress frankly with their families back in China and so on.

The best thing we can do is make sure that those who come here share our values and that we vet them appropriately, but once they're here, we help them understand what our values are and how to live by them and then monitor that. And one of the ways we do that is through disclosures of things like conflicts of interest, are you part of a talent program, and so on. And, again, for the individual at Harvard, he was not a Chinese national. He was not ethnically Chinese.

Mr. BABIN. Right. Right.

Dr. DROEGEMEIER. So it doesn't matter where you're from. You've got to play by the rules, and if you don't, well, simply you don't belong and we toss you out of the research enterprise. And you lose all credibility anyway. And that's I think the value of the integrity that we as researchers hold dear, that if you don't play by the rules, we don't want you, frankly.

Mr. BABIN. Thank you. I know my time is out, but I want to say one quick thing. I'm the Representative of Johnson Space Center in Houston, and I would also like to commend the President and his budget people for giving NASA a 12 percent increase in that budget. We are very appreciative. Thank you, sir.

Dr. DROEGEMEIER. Thank you.

Chairwoman JOHNSON. Thank you very much. I want to say that Mr. Lucas has a bill that has passed the House on—I think it's passed—rural broadband. OK. It's waiting to be voted on in the House.

Dr. DROEGEMEIER. Ah, OK.

Chairwoman JOHNSON. But he's been very thoughtful, and I want to point out that it doesn't have to be deep east Texas. It can be deep south Dallas—

Mr. BABIN. Amen.

Chairwoman JOHNSON [continuing]. Where we need the broadband.

Dr. DROEGEMEIER. Now, Mr.—Ranking Member Lucas, should we tell her we call that Baja Oklahoma? We don't want to say that, right?

Chairwoman JOHNSON. Yes.

Dr. DROEGEMEIER. We won't go there.

Chairwoman JOHNSON. Thank you. Ms. Bonamici.

Ms. BONAMICI. Thank you, Chairwoman Johnson and Ranking Member Lucas. We could use some rural broadband in Oregon as well.

Dr. DROEGEMEIER. welcome.

Dr. DROEGEMEIER. Yes, good to see you.

Ms. BONAMICI. Thank you for being here. First, I want to align myself with Mr. Lipinski's concerns about the cuts in the Department of Energy to ARPA-E and the Energy Efficiency and Renewable Energy budgets.

The climate crisis is an existential threat, and I'm extremely concerned that in your first appearance here before this Committee this Congress you didn't even mention climate change except for when you were responding to questions from the Chairwoman and Mr. Lipinski. You're the President's top advisor on science policy, and with your background working on extreme weather issues, I'm

alarmed frankly by the Administration's failure to take this issue seriously and to fund research on climate science.

And I do have a budget question, but first, I want to ask a couple questions, yes or no questions, about something that concerns many of us here, as well as many in the scientific community. Dr. Droegemeier, should Federal agencies use the best available science to inform regulatory decisions?

Dr. DROEGEMEIER. Yes.

Ms. BONAMICI. Good. I think so, too. Should agencies implement policies that limit the scope of science that could be used in making decisions, yes or no?

Dr. DROEGEMEIER. Limit the scope of science? I'm not sure what you—

Ms. BONAMICI. That can be considered. Should the scope of science that can be considered in making regulatory decisions be limited, yes or no?

Dr. DROEGEMEIER. Well, I think if it's the best science, it's the best science. Yes, you just put the best science on the table. Yes.

Ms. BONAMICI. And were you consulted on the Environmental Protection Agency's proposed rule titled "Strengthening Transparency in Regulatory Science?" Were you consulted about that?

Dr. DROEGEMEIER. No.

Ms. BONAMICI. It's our understanding that this draft supplemental rule was submitted to the Office of Management and Budget for interagency review, so has OSTP offered comments on the draft supplemental rule during the interagency review process?

Dr. DROEGEMEIER. I would have to check on that, and I'd be happy to do that and get back to you.

Ms. BONAMICI. Thank you.

Dr. DROEGEMEIER. Sure.

Ms. BONAMICI. I would appreciate that.

Dr. DROEGEMEIER. OK.

Ms. BONAMICI. If the President's top science advisor and in light of OSTP's role in leading interagency efforts on science policy, are you aware of any larger Federal efforts to limit or otherwise censor science?

Dr. DROEGEMEIER. I'm not.

Ms. BONAMICI. Yesterday, there were news reports suggesting that the Interior Department will soon release a proposed Promoting Open Science Rule, which appears to have a similar objective to the EPA's proposed rule. And I have to say I share the concerns of many who are deeply troubled by these proposals that would limit the scope of science used in decisionmaking, jeopardize bedrock environmental standards, and endanger the health and well-being of our communities, so I wanted to share that concern.

Dr. DROEGEMEIER. Thank you.

Ms. BONAMICI. So, Dr. Droegemeier, in your testimony you noted that research and partnerships on ocean science and technology are a priority for the Administration. And I know that OSTP organized a summit on this issue unfortunately without congressional participation last year. Yet the President's budget request would slash funding for the National Oceanic and Atmospheric Administration's National Ocean Service by 37 percent and reduce funding for the Office of Oceanic and Atmospheric Research (OAR) by 40 percent.

I also noticed the concern about the elimination—total elimination of the Sea Grant program that's proposed.

Last year, the United Nations' Intergovernmental Panel on Climate Change (IPCC) released a special report on the ocean and cryosphere in a changing climate that found that the ocean is warming rapidly, it's becoming more acidic, it's losing oxygen, and becoming less habitable to the species that reside in it as a direct result of human-caused greenhouse gas emissions. So how do you reconcile those findings of the IPCC and the Administration's identified priorities with such drastic funding cuts?

Dr. DROEGEMEIER. No, thank you for that. So I'm privileged to serve on the Ocean Committee that was created with the executive order that the President signed. It's got two primary components and two subcommittees. One is on ocean science and the other one is on ocean resource management.

So the S&T part of it is really the critical thing to look at all the aspects of ocean—things that you just mentioned. But also in the summit that we had, it was kind of a multisector summit. And frankly it was the first time really that there was such a summit. So it brought together nonprofits who are investing very heavily in ocean S&T and ocean exploration and also for-profit companies and the government and the university community.

So when you look at all those equities, you look at all the resources, for example, the research vessels that nonprofits like Paul Allen's group is bringing to the table, you know, we partner with them and we get this tremendous multiplier effect. So even though there are cuts to the budget, it doesn't mean that the science research is being cut because when you partner like that, you're actually leveraging what investments are being made thoughtfully in the government, against all these other folks who have equities as well. And it was an extraordinary event actually where people were saying, OK, now we have a direction where we're going to go in that science and technology for the oceans.

Ms. BONAMICI. And I appreciate the partnership, but I know that solving this crisis is going to require those types of partnerships. However, in light of what we know and what we have learned and how it's affecting not only the health of the ocean, which of course reflects the health of the planet, but also the industries like our shellfish industry in Oregon, for example, very concerned. Our fishing industry, very concerned about the warming waters, about the acidic conditions. It seems like this would be a time in light of that recent report to increase those investments and of course work with the private sector—

Dr. DROEGEMEIER. Right.

Ms. BONAMICI [continuing]. But it's not a time to cut. And my time is expired. Thank you, Madam Chair. I yield back.

Dr. DROEGEMEIER. Thank you.

Chairwoman JOHNSON. Thank you very much. Mr. Gonzalez.

Mr. GONZALEZ. Thank you, Madam Chair. Thank you, Dr. Droegemeier, for being here.

Dr. DROEGEMEIER. Good morning.

Mr. GONZALEZ. Good morning. I want to start and probably spend my whole time on the implementation of SASTA (*Securing American Leadership in Science and Technology Act of 2020*)

through the JCORE Research Security Subcommittee. And thank you for the work that you've done standing that up and kind of pushing that forward. That was a bill that I was pleased to introduce and to see the fruits of that labor are exciting in a lot of ways. But first with the line of questioning I want to start by asking you to help us frame the China challenge specifically at the research institutions. How are they actually going in and influencing the policies at the universities, as well as stealing the technology?

Dr. DROEGEMEIER. It's a great question. So it actually takes many forms. One form is the fundamental issue of academic freedom. So sometimes you have individuals that are coming in and pushing back against certain folks who are being invited to campus to talk. Maybe they're from Tibet or whatever, so there's that dimension.

Another dimension that we've seen is, for example, taking a proposal which is a very, you know, well-conceived, highly rated proposal and sending it to China—we have evidence of this—so that others over there could act on it before our own investigators have a chance to act on it. And sometimes there are groups of people that get together and they agree to review a proposal poorly so it actually won't get funded here and you take that really highly rated proposal and send it over to China.

Another thing of course is actually taking physical materials. We've already seen this, vials of biological agents and things like that that are taken, sharing intellectual property, taking photographs of things, for example, that are export-controlled. So there's a whole variety of ways from undermining the fundamental integrity of the openness of our research enterprise vis-a-vis academic freedom to specific activities that seek to grab hold of particular things of interest to the Chinese Communist Party.

Mr. GONZALEZ. So using our own values of academic freedom against us in some ways, right? What percentage of the theft is conducted directly by folks who are a part of talent programs as opposed to outside of talent programs but still connected to the Chinese Government?

Dr. DROEGEMEIER. That's a great question. We don't really have specific data on that. I think one of the things that we are seeing is that the talent programs that go by a particular name, they tend to morph. They tend to go underground. They're a little bit like a virus. You know, it morphs and it changes. And so we're remaining vigilant to that.

And also I think really trying to educate folks, this is something we've done on our subcommittee, develop best practices, examples of contracts of what the language actually says—if you're part of this talent program you agree to share this information, you agree to not disclose it to a Federal agency or, you know, things like that. It's completely antithetical to our values. Yes.

Mr. GONZALEZ. But you said, and I think this is right, that the names of these things morph and they go underground, right? So I guess I have a little bit of a concern on the reliance of the disclosures specifically because, two things. One, it's a self-disclosure—

Dr. DROEGEMEIER. Right.

Mr. GONZALEZ [continuing]. Right, but then the second is if you're asking about specific talent programs, they could just change the name tomorrow, right?

Dr. DROEGEMEIER. Right.

Mr. GONZALEZ. So kind of help me get more comfortable around that.

Dr. DROEGEMEIER. Sure. No, you're absolutely right. And disclosure is a really big issue and this issue of self-disclosure, it's been that way for a long time. So, No. 1, universities are ramping up their use of these disclosures much more dramatically. No. 2, there has to be periodic audits of these things just like getting pulled out of the——

Mr. GONZALEZ. Is that happening today?

Dr. DROEGEMEIER. We're setting up to do that.

Mr. GONZALEZ. OK.

Dr. DROEGEMEIER. With 54 FBI field offices——

Mr. GONZALEZ. OK.

Dr. DROEGEMEIER [continuing]. You know, universities are not set up to do it. They don't have the information——

Mr. GONZALEZ. Right.

Dr. DROEGEMEIER [continuing]. So the audits need to be done by law enforcement.

The third thing I would say is that we want to make sure that, you know, this stuff is actually shared. And sometimes you can't share information, say, from university to a Federal agency to a private company. And people kind of go underground. They hide by changing institutions, and legally, that information can't be shared. So we're looking now at mechanisms, legal mechanisms or possibly coming to Congress and saying we need to change the laws because if you're not sharing the information, then sometimes people can skirt the rules——

Mr. GONZALEZ. OK.

Dr. DROEGEMEIER [continuing]. And we can't have that.

Mr. GONZALEZ. And I trust you'll update us on any changes that are——

Dr. DROEGEMEIER. Absolutely. And anytime you want to have an update, we're happy to come over and do that. And again, thank you. You've given some tremendous input. I met with some Members the other day, very, very helpful input, and we always welcome that.

Mr. GONZALEZ. Great.

Dr. DROEGEMEIER. Yes.

Mr. GONZALEZ. Again, I'll end with what I started with. I just—I thank you for your work on this.

Dr. DROEGEMEIER. Thank you.

Mr. GONZALEZ. It's a major initiative. I'm somebody who thinks we should be increasing our research across the board and making sure we're always at the cutting-edge, but alongside of that we have to secure.

Dr. DROEGEMEIER. Right.

Mr. GONZALEZ. And I know that that's a mandate that you share. So——

Dr. DROEGEMEIER. Absolutely.

Mr. GONZALEZ. With that, I thank you and I yield back.

Dr. DROEGEMEIER. Thank you, sir.

Chairwoman JOHNSON. Thank you very much. Ms. Wexton.

Ms. WEXTON. Thank you, Madam Chair. And thank you, Dr. Droegemeier, for joining us here today.

Dr. DROEGEMEIER. Sure.

Ms. WEXTON. Dr. Droegemeier, are you familiar with the Economic Research Service and the National Institute of Food and Agriculture both within USDA? Are you familiar with those?

Dr. DROEGEMEIER. I've heard of it, but I'm not—I wouldn't say I'm familiar with it, no.

Ms. WEXTON. So I will let you know a little bit about what they do.

Dr. DROEGEMEIER. OK.

Ms. WEXTON. These are two research agencies within the USDA. The Economic Research Service or ERS is USDA's science arm, and it produces statistical analyses to inform policy and industry decisions with real impacts on farmers, consumers, rural communities, and natural resources. The National Institutes of Food and Agriculture or NIFA—

Dr. DROEGEMEIER. Yes, that I know. I know NIFA.

Ms. WEXTON. It funds hundreds of millions of dollars in research grants for agricultural concerns and best practices, things of that nature. So you're aware of that.

Dr. DROEGEMEIER. I'm aware of NIFA, yes.

Ms. WEXTON. OK. So are you aware that last year, these two agencies were relocated from Washington, DC, to Kansas City?

Dr. DROEGEMEIER. Yes.

Ms. WEXTON. And that was done on an expedited basis, correct?

Dr. DROEGEMEIER. I just know they were relocated, yes. I don't know if it was expedited or not, but—

Ms. WEXTON. Did you know that they were—they've been operating with a skeleton crew ever since that relocation took place?

Dr. DROEGEMEIER. I've heard something along those lines, yes, that they haven't been able to bring in as many people to re-staff.

Ms. WEXTON. In fact, at least 75 percent of the staff has left, including all of the publishing staff at ERS and all of the grants management NIFA. And as of last month, ERS had 180 vacancies to fill due to the mass attrition from the expedited agency move. So there's been not only a big loss of workforce but a huge brain drain from those agencies.

And at the time the move that was proposed Secretary Perdue justified it by saying it would ensure that USDA was, quote, "the most effective, most efficient, and most customer-focused agency in the Federal Government." And OMB Director Mick Mulvaney referred to the Federal employees quitting en masse as "a wonderful way to streamline government and do what we haven't been able to do in a long time."

So now the President's current budget request for ERS includes a decrease of \$22.6 million or more than 1/4 of its budget from last year for ERS. Almost 70 percent of that cut comes directly from further proposed reductions to full-time staff in ERS from 329 to 187 positions.

So, Dr. Droegemeier, has the departure of hundreds of employees from ERS and NIFA, which Mr. Mulvaney referred to as “a wonderful thing,” improved the function of Federal science at USDA?

Dr. DROEGEMEIER. I honestly don’t have enough information to answer the question, but I appreciate your explanation. I would have to get more information to really thoughtfully answer that because I really don’t know. I haven’t looked at the science output and what the staffing levels are, and need to be. And these things tend to get complicated when you look more in detail at them. So I’m happy to do that, absolutely.

Ms. WEXTON. Well, if all the grants management staff has left NIFA, does that make it pretty likely that they’re not able to manage grants?

Dr. DROEGEMEIER. Well, it depends on if that function has been transferred somewhere else. Given the fact that they were moved, maybe that function exists somewhere else. So, you know, again, I’d have to really look at the big picture to see, but I’m happy to do that.

Ms. WEXTON. So is OSTP doing anything to support ERS and NIFA in rebuilding the full science capacity of both these agencies?

Dr. DROEGEMEIER. Not to my knowledge.

Ms. WEXTON. OK. Will you commit to do something about that or—

Dr. DROEGEMEIER. I’ll certainly look into that. Yes, I’m aware of it, but, you know, they are a Cabinet-level agency, so they certainly have freedom to manage their department. But I’m happy to be helpful however I can.

Ms. WEXTON. OK. Very good.

Dr. DROEGEMEIER. Yes.

Ms. WEXTON. And both these agencies have vacancies in key leadership positions right now. The ERS Administrator and multiple top-level science leadership positions at NIFA remain vacant or acting. So would you agree that these temporary appointments and vacancies are limiting the representation of USDA’s science efforts and specifically the NSTC Committee on Science?

Dr. DROEGEMEIER. Honestly, I couldn’t answer that today as I sit here, but I’d really love to get schooled up on this and learn more and be able to answer that.

Ms. WEXTON. Absolutely. If you would—

Dr. DROEGEMEIER. Yes.

Ms. WEXTON [continuing]. Please look into it and report—

Dr. DROEGEMEIER. Sure.

Ms. WEXTON [continuing]. Back about your findings because this is really important, and it’s been a big attack on science and as—

Dr. DROEGEMEIER. OK.

Ms. WEXTON [continuing]. Science and technology policy, I think that you would want to get that—

Dr. DROEGEMEIER. Yes.

Ms. WEXTON [continuing]. Corrected.

Dr. DROEGEMEIER. Thank you. Yes, I’ll certainly do that.

Ms. WEXTON. Thank you very much. And I’ll yield back.

Chairwoman JOHNSON. Thank you very much. Mr. Baird.

Mr. BAIRD. Thank you, Madam Chair.

And, Dr. Droegemeier, I appreciate your commitment to science and particularly to research and development. And the fact that you are from rural Oklahoma, I represent a rural area of Indiana, and so I can appreciate the commitment to high-speed internet.

But also, as a meteorologist, I know you're aware that the weather forecasts are dependent on satellite data. There's been a great deal of concern in the weather community that the deployment of the 5G could interfere with forecasting capabilities. And, as you are aware, that could impact agriculture and, you know, we're extremely dependent on weather and weather forecasts as we decide what kind of planting, harvesting, or spraying activities we might do. So would you mind sharing your thoughts on that issue and what steps you're taking to help advocate or mitigate that?

Dr. DROEGEMEIER. Right, absolutely. No, thank you. So OSTP is in fact a part of that conversation in the interagency. Again, Larry Kudlow leads that activity. And with regard to the weather satellites in particular, it was I believe last fall we were looking at that issue. I'm trying to remember exactly the band. It was three—well, anyway, I won't worry about that, the gigahertz band that it was.

But the question was when you have a transmission from a particular 5G antenna, what is the so-called outer band emission? Does it leak over to an area where the passive satellites are? Because the satellites are just listening. They're not transmitting. They're listening for very weak signals. So the concern was if there is interference, it could really inhibit the getting of the satellite data.

The challenge with all this is—and of course we all know we don't ever have as much information as we want, but we don't really have ubiquitous 5G deployment. There's not been extensive testing in the field of these things, so we had to go based on a lot of theoretical analyses and assumptions about what 5G would look like. So we made a best decision which I thought was good but also with the proviso that if there are problems, we left enough wiggle room to be able to address them. You can't go up and change the satellites—they're already flying around—but we came to a spot that I thought was really, really good that will both, you know, be a thoughtful deployment now, but if things go south, we are prepared to be able to address those issues.

Mr. BAIRD. Thank you. Well, then my second question I want to switch back a little bit to the STEM skills. And we've talked a lot about that. We talked a lot about that in this Committee. And I really appreciate you mentioning vocational schools and so on, mentioning welders and the need to really be digitally literate, and it doesn't matter—

Dr. DROEGEMEIER. Right.

Mr. BAIRD [continuing]. And you mentioned even though a lot of those machines and robots operate I wouldn't say on their own, but they still take a human touch and an understanding of the digital concepts, so I just wondered if you might elaborate on that a little more ensuring every American—

Dr. DROEGEMEIER. Sure.

Mr. BAIRD [continuing]. Has the opportunity to—

Dr. DROEGEMEIER. Yes, I think there's tremendous opportunity, and I have to say, you know, it's wonderful to hear the National Science Board, which governs the National Science Foundation, doing a report on the skilled technical workforce. You would think, well, they're focused on Ph.D.-level people. They have this concern and really well-placed, and so they're very thoughtful. And they'll actually be collecting data, which we don't have a lot of data on the skilled technical workforce.

But I think folks in America can be very, very pleased that President Trump focuses on these types of jobs as being valuable, as providing mechanisms to actually get on a pathway toward—if you're a welder, if you're a plumber, if you're an electrician—not just, you know—you can continue to do what you're doing, as an entrepreneur, you can start your own business, but you can also get on to a higher level of skill and pathway. And so now we're working with companies who actually don't look at, oh, what degree do you have or what—you look at the skills because at the end of the day a degree or a job it's just a bunch of skills, so we're kind of taking this down to the fundamental level of skills of the worker, skills of the employer, skills of the producer, whether it's a technical school, a college, or whatever and saying what skills are you really looking for? Don't tell me you need a 4-year degree and 5 years' experience. What are you really looking for? And that is opening enormous horizons for individuals, including our military.

And I want to thank you all for your work with the *Veterans STEM Act* that the President just signed into law, very, very exciting for our men and women in uniform to really look at how do they, you know, get on to different pathways of prosperity for their own skills.

So it's something that the President, Ivanka, and everybody is committed to, and it's making a difference. You look at the data, you know, and the middle class is rising, these folks are getting jobs, they're making more money. That increases the tax base. It's great for the country, it's great for them and their families. It's just a no-lose situation as far as I can see.

Mr. BAIRD. Thank you very much for that.

Dr. DROEGEMEIER. Yes, sir.

Mr. BAIRD. And I yield back. I'm out of time.

Chairwoman JOHNSON. Thank you very much. Mr. Foster.

Mr. FOSTER. Thank you, Madam Chair, and thank you, Dr. Droegemeier, for appearing here.

You know, one of the great things that's happened in Congress, which is sort of rare these days, is the bipartisan consensus that we ought to something like double our research budgets—

Dr. DROEGEMEIER. Right.

Mr. FOSTER [continuing]. Over some time like over the next 10 years and these—you know, they've been put forward by my Republican colleagues here. There are Democratic proposals, and there's also a lot of enthusiasm for that in the Senate. This is obviously a very big contrast with what we're hearing from OMB.

And, you know, so I sort of feel like that situation with the Cuban missile crisis back in the 1960s where the Administration was faced with two very different communications from the Russians and had to just choose to respond to the one that they found

favorable. And I think that's sort of what we're going to end up doing here I hope.

But, you know—and there's sort of a narrative that goes with that, that it's no harm, no foul since the really destructive budgets that the Administration is proposing won't really damage things because Congress will fix it. And that's not quite true, and I wanted to dig into that. The problem is the planning, that when you engage—when you're forced to engage in planning exercises that are constrained by unrealistically decreasing budgets whereas the congressional intent is actually to increase, then you don't undergo the planning and you don't get the projects lined up that will actually be funded. And, you know, there's a danger frankly to the money when it arrives from Congress may end up being misspent. And so that's one thing I worry about, that the pipeline of future projects is sort of artificially being drained out because you're not allowed to plan for unconstrained or actually increasing budgets in many areas.

And so one of the things I'd like to direct your attention to as a way of solving that given the pipeline is dangerously empty of future projects is that you can temporarily solve it with dealing with the infrastructure deficit at the Department of Energy, NIST (National Institute of Standards and Technology), and other places. You know, I am very proud to be the Co-Chair of the National Labs Caucus and—because I spent 23 years at Fermi National Labs. And I made it one of my missions in Congress to drag as many of my colleagues as I can to each of the 17 DOE national labs and others. Just last week, we actually visited Ames Lab, and we're heading to Argonne and Fermilab next month. But—and you can see at every one of these labs that the infrastructure has been underinvested in a while.

This gives you the opportunity when Congress does deliver a more favorable budget to immediately transfer a big slice of that money into an area where it's unlikely to be misspent, that as you define new projects to absorb you know, the—what we hope to be the eventual doubling of budgets that you—the first thing you do is fix the deficit that exists.

And so I was wondering if you can comment on that and, you know, specifically in the context of what we hope are realistically increasing budgets. Are you—will you advocate for American scientific infrastructure from, you know, just completing the construction of experimental facilities that have not the full complement of things, just simply, you know, repairing things? And can you say something about that?

Dr. DROEGEMEIER. Absolutely. No, it's a great point. And in fact, you know, I think science infrastructure is a legitimate part of infrastructure. We talk about roads and bridges and other infrastructure, but obviously to be the world leader in S&T we do need science infrastructure, absolutely the case.

I am a huge fan of the 17 DOE labs. I talk about them all the time, and I think they're absolutely the crown jewel that sets us far apart from other countries that may be investing heavily in AI and quantum and things like that, but we've got our DOE labs, and there's no equal to them anywhere in the world, no question about that.

Back to your other point, though, there was a lot of planning that went into the budget with regard to prioritizing industries of the future and AI and quantum in particular. And so when you do set these priorities, you know, you really do go through a lot of planning. And so when the agencies plan their budgets, you know, OMB gives them a guidance level but then they give them, you know, above guidance and so on. And there are a lot of times the agencies will look well above guidance. They know what their appropriated levels were. So they're not surprised if—

Mr. FOSTER. It's my understanding that actually from, you know, talking to people that probably shouldn't be talking to me that actually that level of planning did not take place. They were not allowed to say what would you do with a doubled budget, that that was—typically, they were more—they were saying what would you do if your budget was cut by 50 or 80 percent—

Dr. DROEGEMEIER. Yes.

Mr. FOSTER [continuing]. Or maybe if you're lucky held flat? But there was not planning for what would you do with a double budget. And that's, you know, the danger there is you won't have the—

Dr. DROEGEMEIER. Yes.

Mr. FOSTER [continuing]. Well-planned-out—

Dr. DROEGEMEIER. Right.

Mr. FOSTER [continuing]. Projects that would absorb that money.

Dr. DROEGEMEIER. I think not with a double budget, right, but, you know, the agencies look at appropriated levels and they say, OK, you know, this is the President's budget. That's what we write our budget to, but if it turns out that Congress appropriates more, we can't all of a sudden say, oh, what do we do with that. So they do plan for much larger increases depending on what Congress does because you do hold the purse strings and they realize that, so they're not caught flat-footed I guess is my point.

Mr. FOSTER. Well, yes, but still, you know, there's a lot of effort that goes into these budgets, and—

Dr. DROEGEMEIER. Right.

Mr. FOSTER [continuing]. That ended up being ignored, you know, and so I think that—I'd just like to urge you to transmit all the way down the chain that you can that we need to start planning for what we all hope to be realistically a doubling of the budgets here and come up with a set of projects. And I think the good starting place for that is, you know, I just last week—because I've been worried about how this would happen, Congressman Luján and I introduced the *National Lab Restoration Modernization Act* to authorize—

Dr. DROEGEMEIER. Right.

Mr. FOSTER [continuing]. Yes, \$6 billion, and that is a short-term starting point, but we need the long-term budget planning to—thank you. And I will—

Dr. DROEGEMEIER. Good point. Thank you.

Mr. FOSTER. I'm over time and—

Dr. DROEGEMEIER. Thanks, Dr. Foster.

Mr. FOSTER [continuing]. Yield back.

Chairwoman JOHNSON. Thank you very much. Mr. Murphy.

Mr. MURPHY. Thank you, Madam Chairman, and welcome, Dr. Droegemeier. I appreciate your appearing before us today.

Budgets are a hard thing to work out with, and we all wish we had an infinite money stream and priorities need to be made. And I congratulate you and give you condolences on how to deal with those.

I want to circle back a little bit on the academic issues with China. A former academic and around that environment for long time, I just want to talk a little bit about the challenges that we face with intellectual property and integrity and everything. Obviously, you know, as one of our former Congressmen noted, there are issues going on with China with the theft of intellectual property. And I'm just wondering what are we doing about getting that down on a granular level to college, universities, presidents, vice presidents, faculty, tenured, et cetera? Because, you know, having served on Board of Trustees previously, it's nice when people from other countries want to come in and pay full fare to expensive universities, and those are welcomed by university presidents and everybody else because they help pay the budget. But on the other hand if these individuals are coming off and literally stealing our country's technology and everything, there is a balance. So how are you guys approaching this? How are we educating our academics to not only the problem but to solutions to this?

Dr. DROEGEMEIER. Yes.

Mr. MURPHY. It's a real major problem.

Dr. DROEGEMEIER. And it's an excellent question, too. And, you know, I think a lot of the IP theft, you know, actually occurs within private companies, not within the academic enterprise. But what we've heard Director Wray say of the FBI is that there are over 1,000 open cases now with the China nexus that are mixture of universities and private companies or a mixture of probably illegal activities and also failure to follow government rules, which maybe are not illegal but they could in the case of Harvard lead to an indictment if you're lying to the government or whatever.

With regard to the level of faculty, you know, as a professor, I realize when I came to OSTP, as we were doing this, that a lot of the conversation that needed to happen was not happening with boots-on-the-ground researchers and frankly graduate students and postdocs as well, so there have been a lot of great discussions with chancellors and presidents, and provosts, but the folks on the frontlines are faculty.

So in going around the country, that's what we've been doing is convening these regional meetings. We've had close to a dozen of those, but also I put out a broad letter to the community from a researcher myself to other researchers to say here's what we're doing, we need your input. And that's why the RFI is out there, to provide that kind of input.

We also work with all the professional societies, Association of American Universities, APLU (Association of Public and Land-Grant Universities), Association of American Medical Colleges, all of them, constantly meet with them. They meet with professors. We go to their annual meetings and so on to communicate. But we're also developing a best practices for universities. And I say we. I'm not saying OSTP but—we're leading the effort but we bring in the

community to all develop best practices together and then share those, but also educational materials. You're absolutely right. We have to teach people about this.

And we also have to teach them about research values. A lot of folks, they wake up in America even if they're from here they don't think about the values and what researchers adhere to.

So we're doing all of those things, as well as looking at policy activities focused around disclosures and monitoring disclosures and things like that. I can tell you the universities are very open to this. Again, if I have a bit of a fear, it's that universities are going to overreach and layer on more than what's needed and create additional administrative burden for the universities, for the researchers. And we also have to be mindful of the agencies as well. So we've got to have the balance of openness and not overreach in terms of addressing the issues. But I think we're finding the sweet spot.

Mr. MURPHY. Yes, I mean that's excellent. Do you feel that the boots on the ground are understanding the gravity of the problem?

Dr. DROEGEMEIER. Yes, definitely. It's way different than it was a year ago.

Mr. MURPHY. OK. All right.

Dr. DROEGEMEIER. It's been a sea change frankly, and I think a lot of it is what you see in the press. We get asked a lot of times, well, how pervasive is this? Well, the answer is we don't really know, but we know there's a lot of it out there. We can't give you a percentage, but I don't think it takes many examples from across the spectrum of institutions for people to say, yes, there's something to this. And we go to classified briefings and we're trying to open up more information that isn't classified that we can share with our university colleagues.

Mr. MURPHY. Yes, will thank you. I mean, that's excellent. I'm heartened to hear that.

Dr. DROEGEMEIER. Yes.

Mr. MURPHY. We're going to be probably experiencing much more of a need for free flow of information now with the coronavirus and some of these other—

Dr. DROEGEMEIER. Great example.

Mr. MURPHY [continuing]. Issues and—

Dr. DROEGEMEIER. Yes.

Mr. MURPHY [continuing]. You know, China has been hiding really what is truly going on over there, and so we have to be open to getting that information from them but also protecting our own information—

Dr. DROEGEMEIER. Right.

Mr. MURPHY [continuing]. At the same time, so—

Dr. DROEGEMEIER. Yes, sir.

Mr. MURPHY. In lieu of my time, I'll yield back.

Dr. DROEGEMEIER. Thank you, sir.

Mr. MURPHY. Thank you.

Chairwoman JOHNSON. Thank you very much. Mrs. Fletcher.

Mrs. FLETCHER. Thank you, Chairwoman Johnson. Thank you for holding this hearing today, and thank you, Dr. Droegemeier, for your testimony.

I'm glad to see you here today, and true to form, when you arrive late and you go at the end, sometimes other people ask a lot of your questions, so I just want to reiterate my interest and concern. You've addressed some of the things that I was concerned about, but I join my colleagues, Mr. Lipinski and Ms. Bonamici, in their concern about the cuts to ARPA-E budget and the widespread budget cuts at DOE. I serve as the Chair of the Subcommittee on Energy on this Committee, and I'm very concerned about the research efforts at DOE. In fact, as we look at our energy future, I think we need to be investing more rather than less on innovative research. And I understand from your prior testimony that, you know, you share some of those concerns. And I just want to reiterate the proposed elimination of the ARPA-E budget is deeply troubling.

I also share the concerns raised by Dr. Baird about 5G, and I'm sure that this is something you know well, the potential impact of 5G on our Nation's weather forecasting capability and impacts on NOAA and NASA, those are very real concerns here as well.

But since they have covered those, I want to move on to the—some questions about the EPA because the EPA has a mission to protect public health and the environment. And as a regulatory agency, EPA's public health protections are built on a foundation of sound science. States, tribes, and local governments look to the EPA to provide scientific and technical expertise to deal with environmental concerns because many don't have the resources or the knowledge to conduct the level of scientific inquiry that is required. In fact, I was just meeting with some constituents yesterday talking specifically about needing EPA guidance in order for them to continue to do certain work. So it's especially evident, and what we were talking about yesterday was the issue of PFAS (perfluoroalkyl substances) contamination, trying to understand lead in water, various issues that are really critical environmental contaminants.

So despite the need for this clear and robust scientific enterprise within the EPA, the President's budget seeks to cut the Agency's topline budget by \$2.4 billion and cut the Agency's R&D budget by 44 percent. How will gutting the R&D capacity of the Nation's premier public health agency help protect the environment and human health?

Dr. DROEGEMEIER. So I think they're focusing their energies, if I could say it that way, on six integrated programs, air and energy, chemical safety, homeland security, human health risk assessment, safe and sustainable water resources, and sustainable and healthy communities. And within that framework the three topline things are PFAS research, lead research, and harmful algal blooms, which are very much aligned with our work in emerging contaminants. We chair—we actually co-lead the National Science and Technology Council Task Force on contaminants of emerging concern. We just actually had a meeting yesterday that I was involved with that talked about the money that is—I think Congress appropriated this, but it's going to, for example, places like Flint to replace lead pipes, so there's a lot of activity there. Also water availability and quality is something that we have a task force on within NSTC as well, within OSTP. So these are really key areas.

And one of the things that we do at OSTP is to look at what is the research agenda? What do we really need to be doing? How do you identify these chemicals? What are the health impacts? How do they get into the water to begin with and, you know, how do we remediate them? Do we simply replace the pipes or, you know, what about groundwater and so on? So we look at that. And we actually developed a plan, a strategic plan, and there's also—I think the DOE has a water security grand challenge, so they're going out and basically saying, if you want to win this prize, grand challenge, how do we do this? And so it is really engaging the broader community.

So I think the research and development is really focused within EPA on these very specific activities and what they call their—you know, their research program, their portfolio, yes.

Mrs. FLETCHER. Well, thank you for that. And I do appreciate it. I think it is encouraging to see the modest increases in the President's budget to R&D efforts on those issues, homeland security, PFAS—

Dr. DROEGEMEIER. Right.

Mrs. FLETCHER [continuing]. Lead in the water. But some of the other cuts to the other research programs and staff within the agency—and certainly we are looking at the closure of the EPA Region 6 office in our area and very concerned about the impact of that as well. So, you know, there are serious concerns about what is happening overall at EPA, and in fact, I would like to ask for unanimous consent to enter an article from the *American Journal of Public Health* that discusses how recent EPA actions have eroded our leadership and our international leadership in environmental health. And I'm running very low on time, but I'd like to enter this in the record and maybe just conclude with your thoughts about how we address the concerns of prominent environmentalists and health professionals that the EPA is no longer leading the global environmental health community.

Dr. DROEGEMEIER. Well, I think ultimately we want to make sure that we are tackling the most important science challenges that we have, whether they're health-related, whether they're environment-related because they're sort of all in together—

Mrs. FLETCHER. Right.

Dr. DROEGEMEIER [continuing]. And that we're focusing our assets. We see this with the coronavirus. You know, all of a sudden within 42 days we have a private company that's taken messenger RNA and created a vaccine for phase 1 clinical trial. So I think there's tremendous capability out there that sometimes we just don't realize until it's needed. So I think ultimately the thing we've done in the President's budget is focus on the high-priority items. Other things of lesser priority do have to maybe move aside or get less funding, but if we really prioritize and we're being very strategic with our assets, and I think that's what the President's budget tries to do.

Mrs. FLETCHER. Well, I appreciate you being here this morning to answer my questions. I've gone over my time, so I will yield back. Thank you.

Dr. DROEGEMEIER. Thank you.

Chairwoman JOHNSON. Thank you. Your statement will be entered into the record. Mr. Weber.

Mr. WEBER. Thank you, ma'am. Dr. Droegemeier, I appreciate you being here.

I appreciated the President's commitment to maintaining American leadership really in a whole variety of ways but also in nuclear science. In 2018 he signed into law some legislation I was privileged to be part of the lead on, the *Nuclear Energy Innovation Capabilities Act*. With that in mind, the next round of nuclear reactors, can you discuss exactly how nuclear energy fits into the Administration's clean, I want to emphasize clean, energy agenda and how the President's budget request supports development of the advanced nuclear reactors in these United States of America?

Dr. DROEGEMEIER. Absolutely. Thank you for that question, sir. I would say that nuclear energy is a very high priority. The versatile test reactor at DOE is really a top line. It's actually in the so-called analytical perspectives of the budget chapter of the document that came out. It is a high-energy neutron reactor, and basically the only one that exists anywhere on the planet right now is in Russia. And so we really cannot depend upon Russia to be developing our next-generation capabilities in nuclear. This thing allows us to develop new nuclear fuels, next generation fuels, but also actual reactor design. And so there's an effort underway to develop this at DOE, and I may get the year wrong but I think it's 2024, 2025 that this thing will be up and running, so that's very important.

Mr. WEBER. So you're saying that Russia will help us with our elections, just not with advanced nuclear design?

Dr. DROEGEMEIER. Not with advanced nuclear reactors, yes.

Mr. WEBER. I got you. Keep going.

Dr. DROEGEMEIER. There's also the transformational challenge reactor at Oak Ridge National Lab, an incredible laboratory. The thing is 3-D printed, so you can imagine developing a reactor that's 3-D printed. So that's really critical. And there's also a Nuclear Reactor Innovation Center at DOE. So those are some of the areas that I think are extraordinary.

And again, I visited a company down in Lynchburg, Virginia, about 3 weeks ago and was absolutely astounded at what I saw in terms of nuclear energy. Small modular reactors as we call them, are very, very safe. The new fuel being developed, you know, basically if the reactor—there's an explosion or whatever, the thing doesn't melt down. It's incredibly safe, could generate 100 megawatts of electricity, up to 300 megawatts, and these things are just, you know, the size of a building column and they're very, very safe. And you look at distributed energy. You look at putting these things in, you know, remote outposts at our military bases. They're really extraordinary.

So I think the issue really right now is economics. Do these things compete with the tremendous energy advances we've made under President Trump with clean energy, with fracking, with shale gas, things like that. Right now, as we heard in this company, there's not—it's not economically as advantageous as we would like. But the research goes on, and I think it's very important to do that, to get the reactor power up, to size down, you

know, the issues of fuel disposal and things like that taken care of. So I'm really excited about the great things happening in nuclear.

Mr. WEBER. Well, I'm glad to hear you say that. And of course part of that is the permitting process and all the revelatory stuff—

Dr. DROEGEMEIER. Right.

Mr. WEBER [continuing]. That we've got to go through, and if we can—

Dr. DROEGEMEIER. Yes.

Mr. WEBER [continuing]. Get that as—and obviously, we want to use good science.

Dr. DROEGEMEIER. Right.

Mr. WEBER. That's been talked about earlier in this hearing. But we want to be sure that we can make it as extremely affordable. It's so clean. I'm pleased to hear that the President's focus is on that.

I'm going to switch gears. The DOE's Fiscal Year 2021 budget request includes robust funding for both the development and application of artificial intelligence and machine-learning technologies across its many, many programs, particularly within the Office of Science. It also reflects the recent establishment of the Department's new Artificial Intelligence and Technology Office. As the Ranking Member of the Energy Subcommittee, I feel very strongly that with its best-in-the-world computing resources and scientific capabilities DOE is uniquely qualified to play a lead role in any national AI strategy. With that in mind, in OSTP's national effort to maintain American leadership in AI, what role do you have in mind for the Department of Energy, Doctor?

Dr. DROEGEMEIER. Yes. DOE is—you know, is an extraordinary agency, but the laboratories are doing amazing things. For example, the Frontier computer that will be displacing Summit down at Oak Ridge in about 2 years I believe is really designed around AI. So it will have incredible capabilities of processing AI. Just Oak Ridge alone is doing some things in cancer screening research in AI, in job reskilling. They're doing some things in, you know, job displacement, things like that.

I just got a note from the Under Secretary of Science yesterday. He said we are actually using this information on these computers now with the coronavirus to look at how you actually simulate the virus or you simulate vaccines for the virus to get way out ahead to look at what possible pathways are the best ones. DOE, you think, well, why would an energy lab do that? Because they have the capability, and they're part of the American R&D enterprise.

So the AI component of the industries of the future is incredibly important and, you know, we are—right now, we just released the 1-year report. We're celebrating the anniversary of the American AI initiative. We just released this report. But in addition to the funding for AI development, very, very important regulatory principles and also a fair use of AI, making sure that we're using it with integrity. We just, through the Office of Management and Budget, led the development of international principles and also a regulatory framework for AI to avoid, you know, potential misuse and things like that, guidance to agencies for private-sector deployment of AI. It's very important.

And Michael Kratsios, the Chief Technology Officer of the United States, has been leading this effort, doing an extraordinary job, and gets to issues of fairness and discrimination of AI and avoiding, you know, misuse of AI. It's very, very important, a huge thing. And certainly the public has to trust AI systems. And as the military said the other day, we have to be able to turn it off if we see a problem with it. So those things I think are equally important to the research which are tremendous capabilities for that and job development and so on, yes.

Mr. WEBER. Well, thank you. I think that's a long way of saying you're in favor of it.

Dr. DROEGEMEIER. I love it.

Mr. WEBER. So I appreciate that.

Dr. DROEGEMEIER. Yes, sir.

Mr. WEBER. Madam Chair, I yield back.

Chairwoman JOHNSON. Thank you very much. Ms. Horn.

Ms. HORN. Thank you. Thank you very much, Chairwoman Johnson.

Dr. Droegeimeier, it's good to be here with you today. I'm sad that I missed the introductions earlier. It's always great to have a fellow Oklahoman in this position. And to echo Congresswoman Fletcher's—her sentiments, there are many things that I'm concerned about that were addressed. But I want to turn our attention now to something that we haven't had the chance to discuss and something you may or may not be familiar with. I think you are. And that's the weather forecasting research and the needs for that in this budget.

As you are undoubtedly aware, this Committee has held several hearings in this Congress when we talked about the need for weather forecasting. And as Oklahomans, we understand that immensely. And as the Chair of the Space and Aeronautics Subcommittee, the importance of our ability to invest in these critical capabilities is incredibly important.

And with the authorization of the Earth Prediction Innovation Center or EPIC at NOAA and the need to continue to improve weather prediction forecasting especially with the changing climate issues and take it from research to integration and operations, I'm concerned that, despite the direction of Congress and the importance of this issue, that the budget request seeks to cut the budget of NOAA research by 40 percent.

So my question is, as a meteorologist and your experience, can you speak about the importance of research to developing the models? And what is the impact on NOAA? Because it's a place that has been chronically underfunded. So what is the likely impact if we're not investing in this research for weather predictions?

Dr. DROEGEMEIER. No, it's a really great question and, you know, we have a lot of NOAA facilities in Norman, at the National Weather Center, so I'm very, very familiar with that. So very, very good point.

The thing about EPIC, I think we're doing something that frankly is epic honestly. We're putting a part of our enterprise where it belongs, out into the community, out into the research community. And that's been a long-standing challenge of the United States where sort of everything was done within NOAA. EPIC is now put-

ting a lot of the development of the models, a lot of the innovation capabilities out into the community, which is going to leverage the private sector, the academic sector. I'm not sure about nonprofits but for sure those sectors. And so that really, again, gives us this force multiplier effect.

So research is incredibly important, but I think also the transition and experimentation of research activities in the operational context, which is one of the things we do at Norman really well, the so-called hazardous weather testbed where we have researchers sitting right next to—literally right next to operational forecasters testing new technologies. EPIC will allow us to do that.

So I think the NOAA budget cuts in OAR, again, it's an issue of priorities, but I think that the thing is we're leveraging the tremendous asset of these other communities, including NSF funding and NASA and places like that, which EPIC is this multifaceted, you know, multisector part of the enterprise.

And one of the things that we've been tasked to do I think by the *Weather Act* is—in OSTP is to look at restructuring the weather enterprise administratively, and we're working actively on that now. I think we'll get a lot of efficiency and a lot of focus and still be able to do the great things you're talking about.

Ms. HORN. And just to echo—wow, that's loud. Congressman Foster's concerns about making sure that we have sufficient research capabilities where—on the cutting edge of developing these technologies where there is yet—

Dr. DROEGEMEIER. Right.

Ms. HORN [continuing]. To be a commercial sector that is—that there's a—

Dr. DROEGEMEIER. Right.

Ms. HORN [continuing]. There's an interest and an ability—

Dr. DROEGEMEIER. Right.

Ms. HORN [continuing]. To do that.

Turning my attention now just in the last minute or so to space research and development and OSTP's place in that, one of the issues that we have addressed on the Space and Aeronautics Subcommittee and on this Committee as a whole is the needs around space weather and the implications for that. So I'd like for you to speak just briefly on what—if you're working on anything or planning to develop any space-related strategies, especially around space weather?

Dr. DROEGEMEIER. Right. That's a great question. We actually have a subcommittee in the National Science and Technology Council on space weather and security and hazards, and it includes things like near-Earth objects and so on. So I think it was about a year ago, it was sometime last year, we released the Space Weather Strategy and Action Plan, and so we're now executing on that. We have working groups to look at implementing that and also working internationally because of course space weather is both a national and an international thing. It also has implications for national security in terms of electromagnetic pulses. It has some similar things there.

So I'd say we're awfully active in that arena, and I'd be happy to sort of do a deeper dive on that with you because it's really im-

portant. The challenge of space weather is it's not top of mind to a lot of people, but if something bad happens, it's a big deal.

Ms. HORN. Exactly. And the national security, the economic consequences, and so many other things on down the line. And of course near-Earth objects also incredibly important——

Dr. DROEGEMEIER. Right.

Ms. HORN [continuing]. With our reliance on space technology. I'd like to dig into this a little bit further——

Dr. DROEGEMEIER. Sure.

Ms. HORN [continuing]. But I'm over my time, so I yield back. Thank you.

Chairwoman JOHNSON. Thank you very much. Mr. Casten.

Mr. CASTEN. Thank you, Madam Chair. Thank you so much for coming.

Dr. Droegemeier, in your opening testimony you said, quote, "We are committed to taking the wise and necessary steps to ensure that America remains the world leader in science and technology research and education for generations to come." And I think you went on to say that the—talk about the importance of government research as a catalyst for innovation and boasted about the budget proposal's 6 percent increase in funding over last year's proposal. It would take a particularly sadistic boss to cut someone's salary by 50 percent and then give them a 6 percent raise and ask for praise for the raise. That's essentially what the budget does. It's a 16 percent cut in DOE R&D funding, 35 percent cut in EPA R&D. ARPA-E is totally eliminated. The programs that are doing critical work to decarbonize the economy and stem the climate crisis are being gutted. I'm not impressed with 6 percent.

And you're sitting here telling us that the President is championing the things that he is destroying. To totally misquote Shakira, the math don't lie, and it is imperative that our lips don't either.

Having said that, I want to shift to a separate matter. I applaud the focus on innovation. I am all for new technology. But there is no meaningful spend here on technology deployment. On a proportional basis deployment, there—it's the last D in RD&D (research, design, and development) is way down. And the—there was a recent International Monetary Fund analysis that said that the United States subsidizes the fossil fuel industry to the tune of \$550 billion a year. That is almost a TARP (Troubled Asset Relief Program) per year.

So my first question is, is it the Administration's position that distorting capital markets to the tune of \$550 billion a year does not interfere with the efficient allocation of capital in those markets?

Dr. DROEGEMEIER. Well, I don't know that I'm qualified to speak to that from an economics point of view, but I can tell you that——

Mr. CASTEN. Well, hang on. I mean——

Dr. DROEGEMEIER. OK.

Mr. CASTEN [continuing]. Just as me—as an individual because, I mean, I can tell you I spent 20 years in the energy industry. Five hundred and fifty billion dollars a year really does distort those markets. If you just want to stipulate that's true, that's OK, but I can't imagine we need an economics degree to say that if you

throw \$550 billion at something, you might actually change things. Put another way, are you up for taking the subsidies away?

Dr. DROEGEMEIER. Subsidies for energy?

Mr. CASTEN. The \$550 billion that the IMF has said is out there.

Dr. DROEGEMEIER. Well, I don't really have—you know, I haven't thought about that deeply, so I'm happy to do that, but let me do address one of the points you made, though, in terms of tech development. I think it's—this goes back to Vannevar Bush and post-World War II. You know, it's very important for the Federal Government to invest in basic research. We all know that that's the seed corn of innovation. We use different terms, but it's very critical. But if you look at the experimental development, the fund that you talked about today, 85 percent of that is funded by industry and 13 percent by the Federal Government. That seems to me to be the right balance because we want the—

Mr. CASTEN. I'm asking a different question.

Dr. DROEGEMEIER. OK.

Mr. CASTEN. If you distort markets as much as the International Monetary Fund says our markets are being distorted, we cannot fall back on this lazy assumption that efficient markets will allocate the capital because markets ain't efficient when they're being distorted that much. That is my concern. And, you know, basically I don't expect you to opine on whether we'll take these barriers away, but—

Dr. DROEGEMEIER. Yes.

Mr. CASTEN [continuing]. If we are not going to take those barriers away, then why are we—why bother innovating? Because all you're doing is putting more technologies at the back of the line that's not moving. We have got to be focused on deployment.

And I want to maybe shift from there that I have a concern that this Administration continues to hide behind R&D as a response to the climate crisis. I am glad to see that people are now embarrassed to stand up in public and deny that climate science is real as an excuse for inaction, but when we have all these distortions in the market, when we know that the markets actually like cheap energy, you know, and if you—if you build a power plant that doesn't have any marginal fuel costs, it's cheap, drives power costs down, markets want it.

But when we know that we need to solve these deployment problems, shifting to a commitment to say, well, we can't move forward because—until the technology is ready is changing the excuse to delay. We don't have time to delay. And we can't celebrate an excuse to delay just because this excuse is somewhat more palatable than the last excuse that said we're going to deny climate science.

So what is the Administration going to do to decarbonize our economy now with technology that exists today?

Dr. DROEGEMEIER. Well, I think there's a couple of things. One of the technologies that's really not a technology is trees, right? And the President committed at Davos to join the Trillion Trees Initiative. But I—again, I just got back from DOE the other day looking at tremendous work that they're doing in clean energy from the Coal FIRST program that they have looking to build coal plants that are more efficient, that actually get to emissions levels that are equivalent to actual natural gas plants—

Mr. CASTEN. Look, I'm out of time but there isn't a coal plant—

Dr. DROEGEMEIER. Yes.

Mr. CASTEN [continuing]. In the world today that's economic. If you add more capital costs and operating costs to the plant, you're just making them less economic. We have to stop delaying. That is an excuse. I yield back.

Chairwoman JOHNSON. Thank you very much. Ms. Stevens.

Ms. STEVENS. Thank you, Madam Chair. And nice to see you, Dr. Droegemeier. Thank you for your courage and your commitment. As the Subcommittee Chair of Research and Technology, we know we have a dotted line to the White House Office of Science and Technology Policy. I've had a lot of joy over the years of working with OSTP and seeing your work in action. We're delighted that the PCAST (President's Council of Advisors on Science and Technology) has been revived and that new members have been added.

I wanted to ask about PCAST. Are you working with them pretty closely in your role?

Dr. DROEGEMEIER. Oh, yeah.

Ms. STEVENS. You're overseeing and you're—

Dr. DROEGEMEIER. Yes.

Ms. STEVENS [continuing]. A member of PCAST? And have they been involved in the budget process at all?

Dr. DROEGEMEIER. No.

Ms. STEVENS. OK.

Dr. DROEGEMEIER. No.

Ms. STEVENS. Yes. And I didn't know if they were weighing in because we've got—well, we got Dow and S.C. Johnson and H.P. labs. We even have—I find this so interesting—a Chief of Operations and Technology Officer from Bank of America. Cybersecurity? Is—

Dr. DROEGEMEIER. Partly that, but what is fabulous about her is that she brings a completely different perspective to science.

Ms. STEVENS. Yes.

Dr. DROEGEMEIER. You know, she doesn't think necessarily like a scientist does, and that's refreshing. So she'll bring up ideas and it's like, wow, I wouldn't have thought of that, you know? So it's been my experience in serving in boards over the years that when you bring folks in from a completely different sector, they add extraordinary value and perspective—

Ms. STEVENS. Yes.

Dr. DROEGEMEIER [continuing]. That you wouldn't have otherwise.

Ms. STEVENS. Diversity of viewpoints and women.

Dr. DROEGEMEIER. Yes. Here, here.

Ms. STEVENS. We love that. That's great, yes. Well, we look forward to maybe having them weigh in and, you know, as—particularly as we're juggling some of this because I know some of these agents—or these representatives care deeply about these programs that we've been talking about today. Obviously, ARPA-E is celebrated on both sides of the aisle. I believe we'll do our job in Congress and recommit to funding it, recommit to prioritizing climate. The Manufacturing Extension Partnership centers, they're essential. And the voice that you all provide is important as well, and we're glad to be seeing, I think, a commitment to basic research

funding as a whole of Committee. And I think we've heard you on that today. We're going to give the message back to the White House that we would like to see these programs fully funded, and we'd like to also maybe ask PCAST to weigh in, too, on some of their broader visions and maybe even spend some time together, you know, if you'd be open to a meeting along those lines.

Scientific integrity has been a big topic of conversation in this Committee. And we've had a couple of hearings about it. I—you might be aware of the GAO (Government Accountability Office) study——

Dr. DROEGEMEIER. Yes.

Ms. STEVENS [continuing]. That came out, and they reference a 2018 survey conducted by the Union of Concerned Scientists that found that, you know, under this current Administration some scientists have experienced some censorship of their work and some of it's been—it's really unfortunate. It's related to climate change, and we don't know why they're doing that. It seems like it's undue political influence. So are you doing anything about this in your role with OSTP to make sure we're not muzzling these voices?

Dr. DROEGEMEIER. So this came up in my hearing last year, and, you know, I absolutely believe that science has to speak for itself. You know, I don't believe in political interference in science. When policy is made—science and policy are very different of course—but the science itself has to be unfettered. Absolutely, I'm committed to that. In fact, in 2010 OSTP issued a memo in fact that the GAO study that came out in April referenced, and it looked at nine agencies, you know, how well are you living up to the principles that OSTP put forward there, and so on. And so I'm absolutely completely committed to that.

And we are looking at integrity in the context of JCORE in terms of research integrity, that sort of thing, which is different than what you're talking about, but I'll make the same offer here that I did last year, and that is if you want to engage on that topic, we're always happy to look at that issue. But I'm glad that the GAO did that study. I thought it was a very important study.

Ms. STEVENS. Yes, it was—look, it's a useful study and, you know, I mean, censorship is a big word. We like to expect best intentions. On the other hand, you know, we kind of have this climate crisis that is going unaddressed, and we want to make sure that we have the adaptations and the utilization of all our great technologies. And so I'd love to encourage you—and I don't know in terms of, you know, how much you're meeting with cabinet officials or different—you know, the—there's Council of Economic Advisers, there's the Council on Environmental Quality——

Dr. DROEGEMEIER. Right.

Ms. STEVENS [continuing]. And things along those lines that give you maybe conduits to talking to people in the agencies as well. I'm someone who worked in a Federal agency as well, so I think the more that they can break down those interagency barriers——

Dr. DROEGEMEIER. Yes.

Ms. STEVENS [continuing]. And have those conversations with you and, you know, look, bureaucracies are bureaucracies, but on the other hand, the pursuit of truth is very, very important for us

here. And maybe the PCAST board as well can be helpful with that. So I don't know if——

Dr. DROEGEMEIER. Yes.

Ms. STEVENS [continuing]. You're doing anything along those lines.

Dr. DROEGEMEIER. We have great relationships with the agencies. I talk to the agency heads all the time and the Under Secretaries and stuff, really, really close working relationship.

But I really appreciate you mentioning PCAST. It's important. And, you know, it got started late enough in the first term that we decided to sort of bring forward some things we wanted them to work on so they could do their own thing but we thought—really focus on AI, quantum, industries of the future——

Ms. STEVENS. Right.

Dr. DROEGEMEIER [continuing]. Workforce, that kind of stuff. And they are running headlong into that.

The other cool thing is two things I just mentioned quickly. We've done the first-ever joint meeting between them and the National Science Board, which I think is really great——

Ms. STEVENS. Fabulous.

Dr. DROEGEMEIER [continuing]. Because they're very different organizations but with the same goals in mind. We're also going to be launching a committee of undergraduate students, graduate students, postdocs, and early career nonacademic professionals in PCAST, the subcommittee, because, you know, they own the future, right? And their voice needs to be at the table. So we were talking about faculty in terms of research security. These young folks who have brilliant ideas, they've got great creative energy, we want them at the table thinking about policy now. So we're very excited. It's never been done before, so we're super excited about it.

Ms. STEVENS. Well, let's commit to spending some time with the subcommittee——

Dr. DROEGEMEIER. Yes, sure.

Ms. STEVENS. —PCAST. This conversation——

Dr. DROEGEMEIER. Please do.

Ms. STEVENS [continuing]. Could certainly continue——

Dr. DROEGEMEIER. Sure.

Ms. STEVENS [continuing]. Especially along the lines of quantum. Thank you.

Dr. DROEGEMEIER. I would love to do that, thank you.

Ms. STEVENS. I'm over. I'll yield back, Madam Chair. Thank you. Thanks, Doctor.

Dr. DROEGEMEIER. My fault.

Chairwoman JOHNSON. Thank you. Mr. Tonko.

Mr. TONKO. Thank you, Madam Chair, and thank you for the opportunity here to share some thoughts with Dr. Droegemeier. And thank you for your leadership, sir.

Dr. DROEGEMEIER. Yes, sir.

Mr. TONKO. I very much enjoyed our earlier conversation on scientific integrity.

Dr. DROEGEMEIER. Yes.

Mr. TONKO. And I enjoyed hearing what you stated to Representative Stevens about juxtapositioning of politics and science. Unfortunately, many of my colleagues have told me that they worry that

supporting strong scientific integrity policies can come off as a partisan issue or an attack on the current Administration. As an engineer with a deep respect for science, Federal scientific integrity standards have been a concern of mine for many years predating the current Administration.

Here in the Science Committee Ranking Member Lucas and Research Committee Ranking Member Baird worked with me to find common ground on scientific integrity legislation that passed out of the Committee in a bipartisan manner. Scientific integrity is a long-standing concern that transcends any one party or political Administration. In fact, I began working on the *Scientific Integrity Act* in the summer of 2016 when we had a Democratic Administration. And the fact remains whether a Democrat or a Republican sits in the Speaker's Chair or the Oval Office, we need strong scientific integrity policies.

So, Dr. Droegemeier, in your view should supporting strong scientific integrity policies be a partisan issue?

Dr. DROEGEMEIER. Oh, no, sir.

Mr. TONKO. And during our Science Committee legislative hearing on the *Scientific Integrity Act*, both Republican and Democratic witnesses spoke of the need for strong scientific integrity policies that transcend politics or partisanship. So—and, Dr. Roger Pielke, the Republican witness, agreed calling on Congress, and I quote, “quickly and in bipartisan fashion pass scientific integrity legislation,” close quote.

As you know, the *Scientific Integrity Act*, H.R. 1709, would establish consistent scientific integrity policies across all of our U.S. agencies. Do you support the goals of the legislation and believe that strong scientific integrity policies are indeed important?

Dr. DROEGEMEIER. Well, I'd have to look at the legislation, sir, but scientific integrity to me, if we're talking about having our researchers do it, we need it everywhere. It's not one place that it exists and another place that it does not, so I don't want to give an official position on it, but I—

Mr. TONKO. How about the goals of the legislation? Do you agree with them?

Dr. DROEGEMEIER. It's been a while since I read it. I'm sure I have read it, but, you know, if the goal is scientific integrity, I'm all for that, yes, absolutely. I'd be happy to get back to you more specifically if that would be helpful.

Mr. TONKO. Thank you. It would be.

If Congress passes this bill and the President signs it into law, would you support this work to have strong scientific integrity policies across all agencies?

Dr. DROEGEMEIER. I think we absolutely need integrity across all agencies to be consistent with our American values and what we're asking our own researchers to do, so absolutely.

Mr. TONKO. Well, and we live in a science-driven world, so it only makes sense to incorporate that into our policy thinking but to leave it as pure science.

Dr. Droegemeier, last year, the President issued an executive order to all Federal agencies to significantly reduce their number of Federal Advisory Committees commonly referred to as FACAs. The National Science Foundation determined that each of its

FACAs were essential for the proper stewardship of its highly technical research programs and thus sought and received an exemption to this order. But my understanding is that the DOE's Office of Science sought no such exemption and is required by the Department to make recommendations regarding the elimination of several of its FACAs. Is this correct?

Dr. DROEGEMEIER. I'm familiar with the NSF situation, not with DOE. I wasn't aware that they had not requested any exemptions. I do note that past Administrations have done the same thing in terms of FACA committees, asked to reduce by like 1/3, both Republican and Democrat Administrations.

Mr. TONKO. Well, then why do you believe that some of the Office of Science's FACAs are no longer of value to guide its advanced research activities?

Dr. DROEGEMEIER. I wasn't aware that they actually hadn't sought a dispensation from removal, so I'd have to talk to Paul Dabbar about that.

Mr. TONKO. And how is cutting so many of our critical Federal agency research investments in half or more going to improve American innovation?

Dr. DROEGEMEIER. I think the key thing here, Congressman, is to really focus and prioritize and realize that it's not just the Federal Government, it's actually the private sector, nonprofits, and so on. We get together, we innovate. Six hundred billion dollars is what was expended I believe probably this year, so I think the key thing is working together to leverage our assets. And the Federal Government absolutely has a critical role to play in funding basic research, no question about it. That's why the President is proposing \$142.2 billion.

Mr. TONKO. Well, I can understand leveraging additional private-sector investment, but why would we reduce the commitment of the Federal—I mean, that means all the more private-sector investment we could get if we don't rollback that Federal commitment.

Dr. DROEGEMEIER. Well, I think, again, the question is what is our priority, and the lesser priorities don't get as much funding. We really put our eggs in the priorities which are AI and quantum for industries of the future and certainly things like nuclear energy and other activities that are expressed in the budget, yes.

Mr. TONKO. It seems to me that the agenda for research is steep and that any rollback from Federal commitment as a partnership to leverage those private-sector dollars is not good sense.

In 2018 the National Institute of Standards and Technology released a green paper with a number of recommendations for improving technology transfer from Federal labs to the private sector. What is the status of implementing those recommendations?

Dr. DROEGEMEIER. I'd have to check with Walt Copan, but they're moving forward with it, and I think it was—the thing is, it wasn't a specific set of activities that were going to be done. It was a set of broad recommendations for America essentially. And I think a lot of them in terms of intellectual property were really well-structured. So I believe they're—they are moving forward. We actually have somebody at OSTP that works on that. I haven't asked them specifically for an update recently, but I certainly could do that and get back to you.

Mr. TONKO. Thank you. Madam Chair, I exceeded my time, so I yield back. I'm sorry.

Chairwoman JOHNSON. That completes our round of questioning, but before we bring this hearing to a close, I'd like to thank you, Dr. Droegemeier, for testifying before the Committee and say that we are pleased to be working with you.

The record will remain open for 2 weeks for additional statements from members and for any additional questions that the Committee may want to ask the witness. The witness is excused—

Dr. DROEGEMEIER. Thank you.

Chairwoman JOHNSON [continuing]. And the hearing is adjourned.

[Whereupon, at 12:03 p.m., the Committee was adjourned.]

Appendix I

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

*Responses by Dr. Kelvin K. Droegemeier*U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

"A Review of the Administration's Federal Research and Development Budget Proposal for
Fiscal Year 2021"

Questions for the Record to:The Honorable Kelvin K. Droegemeier
DirectorWhite House Office of Science and Technology Policy
Submitted by Chairwoman Eddie Bernice Johnson

1. **During the hearing, Representative Lofgren asked you a series of questions about the ITER project. I am following up on the question you were unable to answer at the time. Please provide updated estimates for the resources that will be required from the U.S. in FY2021 to maintain ITER's current schedule and minimize its total project cost.**

ITER is an important project that, if successful, could lead to the development of practical fusion power. The main United States contribution to the ITER project is the Tokamak's Central Solenoid, a five-story superconducting magnet, funded by the Department of Energy's (DOE) Office of Science. DOE is balancing the funding needs of the ITER project with those of other important initiatives in the Office of Science. In FY2021, the Office of Science Request includes \$107 million in funding for continued design and fabrication of the highest priority "in-kind" hardware systems for ITER.¹ This includes continued fabrication of the Central Solenoid magnet system, which consists of seven superconducting modules, structural components, and assembly tooling. The U.S. will also continue the design and fabrication efforts for other hardware systems.

2. **During the hearing, Representative Wexton asked you a series of questions about the relocation of research offices at the U.S. Department of Agriculture and its impact on staffing and mission. I am following up on the questions you were unable to answer at the time.**

- a. **Has the departure of hundreds of employees from ERS and NIFA as a result of the USDA relocation improved the function of federal science at USDA?**

As you know, in August 2018, United States Department of Agriculture (USDA) Secretary Perdue announced the intention to relocate the Economic Research Service (ERS) and the National Institute of Food and Agriculture (NIFA). USDA conducted a Cost Benefit Analysis² of over 300 potential sites in 35 states using a developed set of criteria focused on quality of life, operational and capital costs, workforce statistics, and logistics and infrastructure considerations.

¹ https://www.energy.gov/sites/prod/files/2020/03/f72/doe-fy2021-budget-volume-4_0.pdf

² <https://www.usda.gov/sites/default/files/documents/062819-CBA.pdf>

Based on the analysis conducted, the Secretary selected the Kansas City Region as the next home of ERS and NIFA.³ Over the course of the relocation process, I have spoken regularly with USDA Deputy Under Secretary Scott Hutchins, and he has commented on the efficiency achieved by the relocation, especially in terms of proposals processed, as well as the happiness of the employees living in that region. OSTP will continue to engage with USDA to ensure that ERS and NIFA are able to continue their respective missions of bringing groundbreaking discoveries -- and data -- from research laboratories to farms, communities, and classrooms.

b. Some USDA NIFA Agriculture and Food Research Initiative grant proposals that were submitted in 2019 have yet to be reviewed. What is OSTP doing to support NIFA and ERS in rebuilding the full science capacity of both agencies?

First, OSTP understands that NIFA has obligated all FY 2019 one year grant funds on-time, before the end of the fiscal year. As noted above, Deputy Under Secretary Hutchins recently reported that NIFA processing of grant awards is proceeding ahead of the 2018 pre-relocation pace. In fact, in FY 2020 NIFA processed a greater number of grants than in 2018, implemented six new programs authorized by the 2018 Farm Bill, and advanced Rapid Response grants in response to COVID-19 stakeholder needs.

Beyond engaging with NIFA and ERS on the challenges each agency faced during the relocation to Kansas City, OSTP recently brought together National Science and Technology Council (NSTC) agency leaders to discuss opportunities to create more resilient foundations for the future of the U.S. research enterprise.

c. Due to significant ERS and NIFA staff departures, both agencies have vacancies in key leadership positions. Both the ERS Administrator and multiple top-level science leadership positions at NIFA remain vacant or “acting”. How are these vacancies and temporary appointments limiting representation of USDA science efforts at OSTP, and specifically on the NSTC Committee on Science?

Intensive hiring efforts are currently underway at NIFA⁴ and ERS⁵ to recruit highly qualified candidates for vacant positions, and in late August, USDA named Dr. Spiro Stefanou to lead the ERS as its new Administrator.⁶ With the addition of Administrator Stefanou, ERS key leadership positions are complete. Through the ERS and NIFA relocation, OSTP has continued to engage with USDA representatives through the NSTC Committee on Science as well as other NSTC committees and related work streams.

³ <https://www.usda.gov/media/press-releases/2019/06/13/secretary-perdue-announces-kansas-city-region-location-ers-and-nifa>

⁴ <https://nifa.usda.gov/career-opportunities>

⁵ <https://www.ers.usda.gov/about-ers/careers-at-ers/employment-opportunities/>

⁶ <https://www.usda.gov/media/press-releases/2020/08/31/usda-names-dr-spiro-stefanou-new-ers-administrator>

d. ERS and NIFA employees who opted to relocate to Kansas City are still working at a temporary location – how is this impacting the function of federal science at USDA?

ERS and NIFA employees have been working alongside around 1000 USDA employees across multiple USDA agencies in the Kansas City Beacon Center continuing the agriculture synergies previously held in Washington. The Agencies will remain in that space until the build-out of the permanent office is completed in late October 2020.⁷ The Office of Personnel Management has also announced guidance on human resources flexibilities due to COVID-19, including maximizing telework for the entire Federal workforce.⁸

3. During the hearing, Representative Horn made some comments about the importance of reliable weather forecasting and you referenced the ongoing restructuring of the National Weather Service at NOAA. Can you provide an update on OSTP's efforts to coordinate weather research and forecast innovation activities across the Federal government as directed in the Weather Research and Forecasting Innovation Act? In particular, can you describe what steps OSTP has taken to coordinate these Federal activities with those of the US weather industry, State governments, emergency managers, and academic researchers?

In August 2020, The White House Office of Science and Technology Policy (OSTP), in collaboration with the National Oceanic and Atmospheric Administration (NOAA), announced the creation⁹ of the *Interagency Council for Advancing Meteorological Services* (ICAMS). We created ICAMS to improve the mechanism by which all relevant Federal departments and agencies coordinate policy and practices to ensure the United States' continued global leadership in the meteorological services enterprise. OSTP spearheaded the development of ICAMS in fulfillment of a provision in the Weather Research and Forecasting Innovation Act (Public Law No. 115-25). ICAMS represents the most significant coordination of the Federal meteorological enterprise since the creation of the Federal Committee for Meteorological Services and Supporting Research in 1964. ICAMS harmonizes crucial activities to improve communication and creates a streamlined framework that will allow for more effective collaboration with external groups. OSTP and NOAA convened the inaugural meeting of ICAMS on August 27.

⁷ <https://www.usda.gov/media/press-releases/2019/10/31/secretary-perdue-announces-lease-ers-and-nifa-kansas-city-mo>

⁸ <https://www.opm.gov/policy-data-oversight/covid-19/>

⁹ <https://www.whitehouse.gov/wp-content/uploads/2020/08/Signed-ICAMS-Charter.pdf>

4. In 2018 the National Institute of Standards and Technology released a green paper with a number of recommendations for improving technology transfer from Federal laboratories to the private sector. During the hearing, Representative Tonko asked you about that green paper. I am following up on the question you were unable to answer at the time. Specifically, what is the status of implementing those recommendations, including the status of any associated legislative proposal from the Administration?

The President's Management Agenda¹⁰ charged the Federal enterprise with improving the transition of federally funded innovations from the laboratory to the marketplace. The National Institute of Standards and Technology (NIST) co-leads the effort with OSTP through the Lab-to-Market Cross Agency Priority (CAP) goal,¹¹ which identifies opportunities to optimize technology transfer models and private sector investment in late stage research and development across the Federal government, with a national goal that aims to dramatically increase returns from the more than \$150 billion per year of U.S. Federal investment in research and development.

Recommendations from NIST's *Return on Investment Initiative for Unleashing American Innovation*¹² Final Green Paper,¹³ published in April 2019, has helped inform many aspects of the Lab-to-Market CAP Goal. The September 2020 Lab-to-Market CAP Goal Action Plan Update¹⁴ provides the latest progress towards key milestones.

¹⁰ <https://www.whitehouse.gov/wp-content/uploads/2018/03/The-President%E2%80%99s-Management-Agenda.pdf>

¹¹ <https://www.performance.gov/CAP/lab-to-market/>

¹² <https://www.nist.gov/tpo/return-investment-roi-initiative>

¹³ <https://www.nist.gov/unleashing-american-innovation/green-paper>

¹⁴ https://www.performance.gov/CAP/action_plans/september_2020_Lab_to_Market.pdf

Questions for the Record to:
 The Honorable Kelvin K. Droegemeier
 Director
 White House Office of Science and Technology Policy
Submitted by Congressman Jim Baird

1. **As Ranking Member of the Research and Technology Subcommittee I am very interested in open science, ensuring all Americans benefit from research funded by taxpayer dollars. Under the current open access policy, published work from federally funded research must be made available following a 12 month post-publication embargo period. I understand OSTP has been reviewing this requirement, to consider how to make federally funded science more accessible while preserving the U.S. system of high quality, peer-reviewed publishing of scientific studies. Can you share the status of this review, and how you are engaging stakeholders, including publishers and scientific societies?**

U.S. Federal research funding agencies currently operate under the 2013 OSTP Memorandum, *Increasing Access to the Results of Federally Funded Scientific Research*.¹⁵ Under the memorandum, and the resulting development of agency public access plans, the results of federally funded research are made available within 12 months of publication. Through the National Science and Technology Council (NSTC) Subcommittee on Open Science, OSTP continues to coordinate the implementation of public access plans across Federal agencies and departments and to develop strategies and best practices to further public access to federally funded research products.

To better engage the broader stakeholder community, OSTP earlier this year convened a series of roundtable discussions with commercial, nonprofit, and society publishers; university provosts, vice presidents for research, library directors, and researchers; and Federal and non-Federal research funders on the topic of scholarly communications and public access to the results of federally funded research. OSTP also published a request for information on options for increasing public access to the products of federally funded research¹⁶ and a request for public comment on desirable characteristics of repositories for managing and sharing the data resulting from federally funded research.¹⁷ Responses to the request for information and the request for public comment have been published for public review.¹⁸

In March 2020, OSTP, along with researchers and leaders from industry, non-profit organizations, academia, and the National Institutes of Health, released the *COVID-19 Open Research Dataset*.¹⁹ This effort began with a call to publishers, led by OSTP and joined by over a dozen other countries, to make COVID-related publications and their

¹⁵ https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/ostp_public_access_memo_2013.pdf

¹⁶ <https://www.federalregister.gov/documents/2020/03/31/2020-06622/request-for-information-public-access-to-peer-reviewed-scholarly-publications-data-and-code>

¹⁷ <https://www.federalregister.gov/documents/2020/01/17/2020-00689/request-for-public-comment-on-draft-desirable-characteristics-of-repositories-for-managing-and>

<https://www.whitehouse.gov/wp-content/uploads/2017/11/Desirable-Characteristics-RFC-Comments.pdf>

¹⁸ <https://www.whitehouse.gov/wp-content/uploads/2017/11/Open-Access-RFI-Comments-Reduced-5.pdf>

¹⁹ <https://pages.semanticscholar.org/coronavirus-research>


underlying data publicly available, free of charge and in machine-readable formats, immediately upon publication. The over 134,000 scientific articles now available on the COVID-19 Open Research Dataset (with more added each day) represent the most extensive machine-readable collection of scholarly literature about COVID-19, SARS-CoV-2, and the coronavirus group.

Appendix II

ADDITIONAL MATERIAL FOR THE RECORD

AJPH ENVIRONMENTAL HEALTH WORKFORCE & REGULATION

Endangering the Health of All: Destroying a Half Century of Health Leadership Along With America's Environment

 See also the *AJPH Environmental Health Workforce & Regulation* section, pp. 284–298.

We are saddened to witness the recent erosion of US international leadership in environmental health. Yale University's environmental performance index rates countries across a range of environmental health programs. In 2018, the United States ranked 27th out of 180 countries (<https://bit.ly/36ip7F0>). Controlling for the strong relationship between wealth and environmental programs, the United States now ranks last compared with its affluent peers in Western Europe, Asia/Pacific, and Canada. While the United States ranks high in those areas addressed from the 1970s—for example, air quality, water, and sanitation—it ranks poorly with regard to climate change and other new challenges.

A 50-YEAR RECORD

The 1969 National Environmental Policy Act (NEPA), signed on January 1, 1970, signaled Americans that the nation was creating an environmental ethic. NEPA required an environmental impact statement for significant federal government projects and

for projects that required federal licenses, permits, and funding. NEPA has served as a model for more than 100 countries and perhaps is the most emulated US law. Also during the 1970s and early 1980s, the US government passed other major laws that established the United States as the international champion of environmental health.

Both Democrats and Republicans pressed forward with an ambitious agenda in the face of visibly deteriorating environmental quality and landmark disasters such as the 1969 fire on the Cuyahoga River.^{1–3} Various federal laws established the Environmental Protection Agency (EPA) as the centerpiece of environmental protection, but there were other key players. The Department of Energy, Department of Defense, and Department of Transportation, as well as the Occupational Safety and Health Administration and other federal departments and agencies, developed environmental agendas and received budgets to respond to environmental health challenges.

Congress demanded a governance process grounded in research

to support rules and regulations and embedded science into the enabling laws for the EPA and other agencies, such as the Clean Air Act (CAA). In some instances, it required robust external scientific advisory processes to ensure the quality of science underlying environmental regulations, as with the CAA and the Clean Air Scientific Advisory Committee (CASAC). EPA and other agencies built strong research programs to support their actions, and consequently each state did not need its own large science staff.

America's improvements to the environment in the past 50 years have afforded health for humans and other species and are admired globally. During the period from 1976 to 1980, the first systematic monitoring of blood lead levels found that 88% of US children aged one to five years had blood lead levels of 10 micrograms per deciliter or

higher. By 2007 to 2010, that percentage was down to 0.8%. Generations of children have thereby received the gift of higher intelligence and less nerve damage. Lung function in children has improved, especially in the most air-polluted areas, because of air-protection laws. Rivers that were cesspools and toxic sinks have become swimmable, increasingly fishable, and usable for nearby walking and biking trails. Dozens of pesticides in many products and mixtures found to be seriously toxic across species have been phased out or have had usage amounts dramatically reduced. Virtually all of these improvements grew out of well-balanced and rigorous scientific assessments, though often the ensuing environmental regulations were opposed by economic interests that marshalled powerful political allies. Over time, these actions have made air, water, and food safer and healthier.

We do not assert that the process of leadership by the national government on the environment was smooth over the last half century. Much of the environmental legislation has been challenged legally and politically as too expensive, as leading to

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unfunded mandates, and as taking power from states. Senior EPA staff found that budget allocations were not well matched to risk-related priorities.^{4,5} However, the federal government responded to new challenges, such as lead paint and leaded gasoline, asbestos, and environmental justice, and provided leadership in calling for the Intergovernmental Panel on Climate Change, the United Nations' climate change science research, to be separated from the United Nations' political processes. On balance, the governance process worked and moved forward a progressive national agenda that has had international implications.

THE ONGOING ROLL BACK

Recent actions affecting the pathways by which science is incorporated into EPA's regulations have reversed more than four decades of congressional and agency actions. Changing selection processes have led to a replacement on advisory committees of academic scientists with industry consultants.⁶ In a recent irrational twist, an academic scientist who receives funding from EPA through a competitive peer-reviewed process, therefore presumably among the most knowledgeable on the subject, is precluded from providing advice to EPA because of an alleged conflict of interest. Yet, the door has been opened for industry scientists to participate without concern for conflict of interest.

Two congressionally mandated committees—the CASAC, which provides specific recommendations concerning the standards for major outdoor pollutants such as ozone and particulate matter,

and the EPA Science Advisory Board (SAB), which is chartered to provide broad input on EPA scientific issues—have been egregiously affected. The usual internal processes for selecting CASAC members have been changed, and much of the key epidemiological evidence is being excluded. As mandated by Congress in the 1977 CAA Amendments, CASAC has seven members, one of whom must be from a state agency. However, for the first time, CASAC has three of its seven members from state agencies with all three reporting to Republican governors. In addition, the panel's pollutant-specific experts have long been brought in to supplement the charter members. The additional scientists brought on for the airborne particulate matter review were dismissed.

SAB's input has also been severely restricted. For example, it was not consulted on one of the most significant proposed actions of the current EPA leadership: requiring public release of the raw data from any study used as the basis for regulation, the so-called Transparency Rule, which we believe makes it more difficult to change air and water rules because epidemiological data are protected by confidentiality agreements and therefore can no longer be used. After receiving public input that stressed the Health Insurance Portability and Accountability Act (HIPAA) issues, the SAB was asked for advice to fix the HIPAA issue, in essence treating SAB as technicians to fix a faulty monitoring instrument rather than to give advice on the scientific implications. Particularly worrisome was that the SAB members were told at the last minute to send in individual comments rather than develop a

consensus report that would be more representative of the opinion of the scientific community.

IMPORTANT STEPS

It has taken a short time to weaken and in some cases tear down the international leadership position the United States has long held. Environmental and ecosystem health are at risk; continued attention is needed to the “legacy” issues, and we are ill-equipped to deal with the new challenges related to climate change, emerging infectious diseases, food security, and cascading and cumulative environmental health risks. The US public health community needs to deeply engage with the political process as individuals and to act as a strong professional voice in a vigorous effort to re-establish itself as a force guiding actions to curb environmental threats. It needs to engage the public broadly, particularly youths who face the future risks of these threats. We need to collectively work with progressive states and local governments to promote the programs that the federal government has backed away from and work with far-sighted businesses and nongovernment organizations to push for stronger, not weaker, environmental management. We also need to continue to be central players at the international level by writing, joining committees, and engaging with international colleagues and audiences on building science.⁷ Tragically, without action, environmental quality could go backward, and we need to slow the acceleration of climate-impacted outcomes and reverse the painful pace of environmental degradation. With future administrations, there may be

support for restoring what this administration has damaged. We need to be ready for that opportunity. **AJPH**

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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