



ADVANCING AMERICA'S GLOBAL LEADERSHIP IN SCIENCE & TECHNOLOGY

TRUMP ADMINISTRATION HIGHLIGHTS: 2017–2020

OCTOBER 2020

ABOUT THIS DOCUMENT

“Advancing America’s Global Leadership in Science and Technology – Trump Administration Highlights: 2017-2020” provides a selection of significant investments, policies, and other actions undertaken by President Trump and Federal departments and agencies during the Administration’s first term to advance science and technology progress.

About the Office of Science and Technology Policy

The Office of Science and Technology Policy (OSTP) was established by the National Science and Technology Policy, Organization, and Priorities Act of 1976 to provide the President and others within the Executive Office of the President with advice on the scientific, engineering, and technological aspects of the economy, national security, homeland security, health, foreign relations, the environment, and the technological recovery and use of resources, among other topics. OSTP leads interagency science and technology policy coordination efforts, assists the Office of Management and Budget with an annual review and analysis of Federal research and development budgets, and serves as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans, and programs of the Federal Government. More information is available at <http://www.whitehouse.gov/ostp>.

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We also acknowledge the tireless and dedicated staff within The White House Office of Science and Technology Policy and elsewhere across the Executive Office of the President. Their efforts during the first term of the Trump Administration helped make many of the highlights featured in this document possible.

LIST OF COMMON ACRONYMS

AI	Artificial Intelligence
COVID-19	Coronavirus Disease 2019
CTO	Chief Technology Officer
DARPA	Defense Advanced Research Projects Agency
DHS	Department of Homeland Security
DOC	Department of Commerce
DoD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOJ	Department of Justice
DOL	Department of Labor
ED	Department of Education
EPA	Environmental Protection Agency
FCC	Federal Communications Commission
FDA	Food and Drug Administration
FY	Fiscal Year
IoT	Industries of the Future
JCORE	Joint Committee on the Research Environment
NASA	National Aeronautics and Space Administration
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
ML	Machine Learning
NSA	National Security Agency
NSTC	National Science and Technology Council
NSF	National Science Foundation
OECD	Organization for Economic Co-operation and Development
OMB	Office of Management and Budget
OWS	Operation Warp Speed
OSTP	Office of Science and Technology Policy
PCAST	President's Council of Advisors on Science and Technology
QIS	Quantum Information Science
QIST	Quantum Information Science and Technology
R&D	Research and Development
S&T	Science and Technology
STEM	Science, Technology, Engineering, and Mathematics
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
USGS	United States Geological Survey
USPTO	United States Patent and Trademark Office
VA	Department of Veteran Affairs

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“We look at tomorrow and see unlimited frontiers just waiting to be explored. Our brightest discoveries are not yet known. Our most thrilling stories are not yet told. Our grandest journeys are not yet made...”

Donald J. Trump
President of the United States



INTRODUCTION

“We hold the future of science in our hands and must ensure it inspires future generations, unites us locally and globally, and guides our way in challenging times that also are filled with amazing opportunities.”

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

Over the past 75 years, America has positioned itself as the unquestioned global leader in science and technology (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 research and development (R&D)—an estimated total of \$580 billion in 2018—but also to work in mutually complementary ways to generate the discoveries and innovations that fuel economic prosperity, enhance health and wellbeing, and improve national security.

Over the past four years, President Trump and the entire Administration have taken decisive action to help the Federal Government do its part in advancing America's global S&T preeminence. The policies enacted and investments made by the Administration have equipped researchers, health professionals, and many others with the tools to tackle today's challenges, such as the COVID-19 pandemic, and have prepared the Nation for whatever the future holds.

In “Advancing America's Global Leadership in Science and Technology: Trump Administration Highlights from the Trump Administration's First Term: 2017-2020,” we document examples of key actions taken by The White House and Federal departments and agencies to accelerate the Nation's S&T enterprise. We also illustrate the impact of these actions on the progress of S&T and, ultimately, the livelihood of the American people.

Had space permitted, numerous other examples could have been included, reflecting the pioneering spirit and creative abilities of the women and men who dedicate their lives to the advancement of knowledge and the betterment of life for all.

ACCELERATING AMERICAN LEADERSHIP IN THE INDUSTRIES OF THE FUTURE

“The United States is the proud home of the greatest technological breakthroughs the world has ever known, from creating the modern Internet to putting humans on the Moon. Emerging technologies will lead to transformative benefits for the American people in healthcare, communications, manufacturing, agriculture, transportation, security, and beyond.”

Michael Kratsios, Chief Technology Officer of the United States

Since inauguration in January 2017, the Trump Administration has recognized the profound importance of American leadership in the “Industries of the Future” (IoF), including artificial intelligence (AI), quantum information science (QIS), advanced communications/5G, advanced manufacturing, and biotechnology—as well as the future computing ecosystem that underpins advances in IoF and the autonomous and remotely piloted vehicles that are enabled by IoF. These industries promise to revolutionize the delivery of education and healthcare, transform transportation and the way we communicate, provide new tools and techniques to solve previously intractable problems, and ensure the Nation can compete and win in a rapidly changing global environment.

In the summer of 2017, The White House held its first event on American Leadership in Emerging Technologies,¹ gathering our Nation’s brightest academic minds and top industry leaders to discuss opportunities and challenges to advancing innovation. This kicked off an effort that has grown and accelerated since, leading to the development and execution of bipartisan legislation, national strategies, and Executive Branch actions and initiatives.

Artificial Intelligence

The Trump Administration recognizes AI as a key industry of the future. AI will support economic growth, strengthen national security, and help all Americans live longer, healthier, and happier lives. During the first term, the Trump Administration has taken numerous actions to fortify American leadership in AI. The Trump Administration has prioritized and delivered record amounts of AI R&D investment, facilitated Federal coordination and created a national strategy, led the development of the first intergovernmental statement on AI principles, issued the first-ever strategy for engagement in AI technical standards, published the first-ever reporting of government-wide non-defense AI R&D

spending, and released the first-ever U.S. AI regulatory document for the trustworthy use of AI technologies in the private sector. Collectively, the actions taken during the Administration’s first term have laid the foundation for continued American global AI leadership for the years and decades ahead.

HIGHLIGHTS INCLUDE:

Launching the American AI Initiative

In February 2019, President Trump signed the Executive Order on “Maintaining American Leadership in AI”, launching the Nation’s AI Strategy—the American AI Initiative.² This strategy was informed by the May 2018 White House Summit on AI for American Industry,³ which brought together senior experts from across the United States to discuss policies needed to ensure American leadership in AI. This strategy includes several important pillars: prioritizing R&D investments in AI; strengthening AI infrastructure by making Federal data, models, and computing resources more available to trusted AI R&D experts; removing barriers to AI innovation by establishing guidance for AI regulation and governance; preparing the U.S. workforce with skills needed to adapt and thrive in the age of AI; and promoting an international environment that supports American AI research and innovation and opens markets for American AI industries. During the first year of the AI Initiative, the Administration made significant progress towards implementing the strategy as detailed in the “American AI Initiative: Year One Annual Report.”⁴

Developing a National Strategy for AI R&D

To ensure the Nation’s AI R&D investments remain at the forefront of technology, the Administration released the updated national strategy for AI R&D, “National AI R&D Strategic Plan: 2019 Update.”⁵ This plan defines eight key areas of priority focus for Federal agencies that invest in AI R&D, with a strong focus on long-term investments that



Caption: OSTP Director Kelvin Droegemeier, U.S. CTO Michael Kratsios, and other Administration officials join President Donald J. Trump for the signing of the Executive Order on Maintaining American Leadership in AI on February 11, 2019.

Credit: Official White House Photo by Joyce N. Boghosian

drive future technological breakthroughs. Progress toward advancing these R&D priority areas was documented in the “2016-2019 Progress Report: Advancing Artificial Intelligence R&D.” The progress report demonstrates the significant depth and breadth of Federal programs and investments focused on AI.⁶

Doubling R&D Spending in AI

As part of the Nation’s AI Strategy, the President prioritized Federal R&D investment in AI for the first time in U.S. history.⁷ In 2019, President Trump committed to doubling QIS and nondefense AI R&D over two years.⁸ This includes \$1.5 billion in the President’s FY 2021 Budget for AI—a 54 percent increase over the President’s FY 2020 Budget.

Tracking and Measuring Federal AI R&D investment

As called for in the American AI Initiative, starting with the FY 2020 Budget, agencies now annually report Federal investments in nondefense AI R&D through the “Networking and Information Technology Research and Development (NITRD) Program’s Supplement to the President’s Budget.”^{9,10} This new process provides an important mechanism and baseline for consistently tracking America’s prioritization of AI R&D investments going forward.

Launching AI Institutes

In August 2020, The White House, the National Science Foundation (NSF) and additional Federal partners announced \$140 million in awards over five years to seven NSF-led AI Research Institutes.¹¹ These collaborative research and education institutes will focus on a range of AI R&D areas, such as machine-learning (ML), synthetic manufacturing, precision agriculture, and forecasting prediction. Research will take place at universities around the country. NSF anticipates making additional AI Research Institute awards in the coming years, with more than \$300 million in total awards, including contributions from partner agencies, expected by next summer. Overall, NSF invests more than \$500 million in AI activities annually and is the largest Federal driver of nondefense AI R&D.

Coordinating Federal Activities

To ensure coordination and efficient use of taxpayer AI R&D dollars across the Federal Government, in May 2018, The White House chartered the Select Committee on Artificial Intelligence under the National Science and Technology Council (NSTC). The Select Committee identifies strategic opportunities for the Government to help advance AI research and partnerships. At the agency and department

level, several new AI centers and offices have been established during the first term, including the Department of Defense (DoD) Joint AI Center (2018), the Department of Energy (DOE) AI and Technology Office (2019), the General Services Administration (GSA) AI Center of Excellence (2019), and the Department of Veteran Affairs (VA) National AI Institute (2019).

The White House also hosted the 2019 summit on “Artificial Intelligence in Government,” which brought together over 175 leaders and experts from government, industry, and academia, to spark ideas for how the Federal Government can adopt AI to achieve its mission and improve services to the American people.¹²

Harnessing AI for National Defense

In February 2019, the DoD released its AI Strategy, which focuses on using AI to advance our Nation’s security and prosperity.¹³ The DoD AI Strategy defines the Joint AI Center as the focal point of DoD’s AI efforts,¹⁴ and outlines strategic aims in delivering AI-enabled capabilities for key missions; partnering with leading private sector technology companies, academia, and global allies; cultivating a leading AI workforce; and leading in military ethics and AI safety. DoD’s work is having impact even beyond defense, demonstrated by the creation of the First Five Consortium in August 2020,¹⁵ which aims to use AI to mitigate the impact of natural disasters in the United States. In September 2018 the Defense Advanced Research Projects Agency (DARPA) launched the \$2 billion AI Next Campaign to create the next wave of AI technologies that can adapt to changing situations and demonstrate increased robustness, reliability, security, performance, and applications.¹⁶

Promoting Federal Engagement in AI Technical Standards

As directed by the American AI Initiative, in August 2019, the National Institute of Standards and Technology (NIST) issued the “Plan for Federal Engagement in Developing Technical Standards and Related Tools,” which reports on the current state, plans, challenges, and opportunities regarding the development of AI technical standards and related tools, and priority areas for Federal involvement.¹⁷ The Federal Government advances the development of technical standards and related tools in support of reliable, robust, trustworthy, secure, portable, and interoperable systems that use AI technologies. These activities ensure that technical standards for AI reflect Federal priorities for innovation, public trust, and confidence.

Establishing U.S. AI Regulatory Principles

For American innovation to flourish, the Federal Government must remove barriers, streamline processes, and avoid imposing burdensome regulation. This is especially important for emerging and critical fields of S&T, including

AI, where existing regulatory frameworks are often inadequate. In early 2020, The White House Office of Management and Budget (OMB) issued a draft memorandum for public comment¹⁸ providing the first ever guidance to all Federal agencies to inform the development of regulatory and non-regulatory approaches to the use of AI in the private sector. The memorandum directs agencies to consider ways to reduce barriers to the development and adoption of AI technologies, consistent with the principles of free markets, federalism, and good regulatory practices.

Regulatory Framework for AI Medical Devices

AI- and ML-based software has the potential to leverage vast amounts of data to provide earlier disease detection, more accurate diagnosis, and development of personalized diagnostics and therapeutics. In 2019, the U.S. Food and Drug Administration (FDA) published a draft regulatory framework focused on “software as a medical device” (SaMD) to ensure that AI- and ML-based software is safe and effective and that this emerging technology reaches patients and healthcare professionals.

Federal Agencies in Action: Using AI and Genomics to Improve Diagnostics

NIH [researchers are proving](#) that whole genome sequencing, combined with AI, can now be used to diagnose genetic diseases in seriously ill babies in less than 24 hours. By developing new technologies that streamline the approach and accelerate every step in the sequencing process, it is possible to obtain whole-genome test results faster than ever before. Combining this new sequencing methodology with ML methods that sift through all of the genomic data to search for potential disease-causing variants, and by integrating this data with a clinical language processing system, researchers could extract relevant information from the child’s electronic health records and reach a diagnosis in under 20 hours.

Developing an AI-ready American Workforce

Our Nation’s continued leadership in AI, QIS, and the other Industries of the Future relies on leveraging our greatest resource—the American people.¹⁹ To build and prepare the American workforce of the future, the Trump Administration has placed important emphases on science, technology, engineering, and mathematics (STEM) education, Pell Grant reform, apprenticeships, and reskilling and upskilling opportunities. In addition to these efforts—described in detail in the “[STEM Education and Workforce Development](#)” section below—the Administration has targeted the development of an AI-ready workforce. President Trump directed all Federal departments and agencies to prioritize AI-related apprenticeship and job training programs and opportunities. NSF’s new National AI Research Institutes program will also contribute to workforce development. In addition, the President’s FY 2021 Budget invested \$50 million at NSF on education and workforce

development for AI and QIS, with focused efforts in outreach to community colleges, Historically Black Colleges and Universities (HBCU), and Minority Serving Institutions.²⁰

Promoting American AI Values on the World Stage

The Administration continues to advocate for the development of new AI technologies in a way that advances innovation, promotes public trust, protects civil liberties, and remains consistent with American values. In March 2018, OSTP negotiated the 2018 G7 Innovation Ministers' Statement on Artificial Intelligence, following an AI outcome document from the 2017 G7 innovation ministerial, which recognizes the importance of AI innovation for economic growth and supports efforts to promote trust in the adoption of AI technologies.²¹



Caption: U.S. CTO Michael Kratsios leads the U.S. delegation to the G7 Technology Ministerial in Paris, France, in May 2019.

Credit: G7 Presidency

In May 2019, the United States led the development of the Organization for Economic Co-operation and Development (OECD) AI Principles, which were adopted by 42 nations. These principles promote the trustworthy and innovative development of AI, and aim to ensure that AI systems are designed to be robust, safe, fair, and trustworthy.²² In June 2020, the United States joined Australia, Canada, France, Germany, India, Italy, Japan, Mexico, New Zealand, the Republic of Korea, Singapore, Slovenia, the United Kingdom, and the European Union to create the Global Partnership on Artificial Intelligence (GPAI).²³ GPAI is an international and multi stakeholder initiative to guide the responsible development and use of AI, grounded in human rights, inclusion, diversity, innovation, and economic growth.

In September 2020, the Trump Administration announced the signing of the Declaration of the United States and the United Kingdom on Cooperation in Artificial Intelligence Research and Development.²⁴ The cooperation agreement between the two nations includes recommending priorities for future cooperation in R&D areas where each partner shares a strong common interest; coordinating the planning and programming of relevant research activities, including promoting researcher and student collaborations and

public-private partnerships; and promoting R&D in AI focusing on fundamental advances and challenging technical issues such as explainability and fairness.

Quantum Information Science

“It’s critical the United States, guided by American values and powered by the American workforce, drives quantum innovation and discovery on the world stage.”

Michael Kratsios, U.S. Chief Technology Officer

Like AI, QIS has the potential to enable new technologies and opportunities for the Nation. Researchers will be able to tackle previously unsolvable problems and explore new domains of communication, sensing, and computation. QIS will improve our industrial base, creating new jobs and entirely new industries in the process, while helping keep America safe. During the first term, the Trump Administration has taken numerous actions to realize the enormous potential of QIS.

HIGHLIGHTS INCLUDE:

Signing the National Quantum Initiative Act

In December 2018, the President signed the National Quantum Initiative Act (NQIA),²⁵ which established a National Quantum Coordination Office and authorized robust Federal funding for QIS R&D activities. This includes investing in quantum consortia—research centers where industry, government, non-profits, and academia can come together to advance QIS.



Caption: President Donald J. Trump signs the National Quantum Initiative Act into law with Deputy Chief of Staff Chris Liddell, U.S. CTO Michael Kratsios, and Advisor to the President Ivanka Trump on December 21, 2018.

Credit: Official White House Photo by Shealah Craighead



Caption: U.S. CTO Michael Kratsios visits Fermi National Laboratory to learn more about the lab’s quantum research efforts.
Credit: OSTP

Establishing the National Quantum Coordination Office

Following the December 2018 signing of the NQIA, in March 2019, OSTP launched the National Quantum Coordination Office (NQCO) to coordinate the more than 13 different agencies working together on the National Quantum Initiative.²⁶ The office works with stakeholders across the Government to ensure quantum R&D efforts enable strong American leadership in this industry of the future. With the signing of the National Defense Authorization Act (NDAA) in December 2019, the NQCO will also help coordination efforts for the defense and intelligence communities. By engaging across the public and private sector, the NQCO will help ensure that we can take full advantage of QIS and technology.

Advancing National Strategies and Coordination

In September 2018, The White House convened the “Summit for Advancing American Leadership in Quantum Information Science.” Participants included 14 Federal agencies, Nobel Laureates, technical experts, international luminaries, university leaders, American business leaders, and renowned academics and researchers who are

prioritizing QIS. The summit focused on taking a science-first approach to QIS development, creating a quantum-smart workforce, and engaging with the innovative ecosystem surrounding QIS.²⁷ Also in September 2018, the NSTC Subcommittee on Quantum Information Science published a strategic overview for QIS and established next policy steps for implementation.²⁸ At the same time, NIST announced the creation of the Quantum Economic Development Consortium (QEDC). The QEDC is working to expand United States leadership in quantum research and support the growing industry in this important sector.²⁹

In February 2020, the NQCO released “A Strategic Vision for America’s Quantum Networks” to encourage fundamental research on ways to link quantum computers and quantum sensors together.³⁰ Recognizing that quantum networks will provide a platform with novel scientific and engineering capabilities, the strategic vision encourages researchers and entrepreneurs to explore new applications for quantum networks. The vision also prioritizes work on the foundational components and protocols that will be required to create and operate quantum networks.

A Blueprint for the Quantum Internet

In July 2020, the DOE published a [blueprint strategy](#) for the development of a national quantum internet, bringing the United States to the forefront of the global quantum race and ushering in a new era of communications. Around the world, consensus is building that a system to communicate using quantum mechanics represents one of the most interesting technological frontiers of the 21st Century. Scientists now believe that the construction of a prototype will be within reach over the next decade. The DOE blueprint highlights essential research needs, describes the engineering and design barriers, and sets near-term goals.

In February 2020, scientists from DOE's Argonne National Laboratory in Lemont, Illinois, and the University of Chicago entangled photons across a 52-mile "quantum loop" in the Chicago suburbs, successfully establishing one of the longest land-based quantum networks in the Nation. That network will soon be connected to DOE's Fermilab in Batavia, Illinois, establishing a three-node, 80-mile testbed.

Creating a quantum network testbed will require intense coordination among U.S. Federal departments and agencies—including DOE, NSF, DOD, NIST, the National Security Agency, and NASA—along with National Laboratories, academic institutions, and industry.

Quantum.gov and Quantum Frontiers

In October 2020, OSTP and the NQCO launched quantum.gov as the public presence of the National Quantum Initiative and national quantum coordination activities. The NQCO also released the "Quantum Frontiers" report³¹ developed with input from Federal, industry, and academic leaders to identify priority areas that need continued research to enable the full potential of QIS. This includes harnessing quantum information technology for precision measurements, targeting materials science, and understanding the universe through QIS. The report is intended to focus and organize the entire QIS research and industrial community around key questions in the years ahead.

Investing in QIS R&D Leadership

American leadership in quantum relies heavily on Federal investment in fundamental research and collaboration with industry and academic partners. To support this, President Trump requested \$435 million for quantum R&D in the FY 2020 Budget. In 2019, the President committed to doubling QIS R&D by FY 2022.³² The FY 2021 Budget includes \$700 million for QIS—a 50 percent increase over the FY 2020 Budget.

Launching QIS Institutes

In July 2020, The White House and NSF announced³³ \$75 million for three new Quantum Leap Challenge Institutes designed to have a tangible effect in solving fundamental challenges in quantum information over the next five years. In August 2020, The White House and DOE announced³⁴ up to \$625 million over five years to five QIS Research Centers that will be led by DOE National Laboratory teams at Argonne, Brookhaven, Fermi, Oak Ridge, and Lawrence Berkeley National Laboratories. Each Center will incorporate a collaborative, multi-institution research team. The private sector and academia will be providing another \$300 million in contributions for the centers. The centers will focus on a range of key QIS research topics including quantum networking, sensing, computing, and materials manufacturing. This critical, fundamental R&D will ensure our Nation

has a strong foundation for the future of commercial QIS-enabled technologies.

Collaborating with International Partners

In December 2019, the United States and the Government of Japan signed the Tokyo Statement on Quantum Cooperation³⁵ in support of continued collaboration in R&D to advance quantum information science and technology (QIST) for economic, societal, and security benefits. The statement encourages increased engagement in QIST through international conferences and events; supports cooperative efforts to prepare the next generation of QIST scientists and engineers; and promotes the sharing of research methodologies, infrastructure, and data.

Preparing Tomorrow's Quantum Workforce

In May 2019, OSTP hosted The White House Academic Roundtable on Innovation in QIS to examine the development of quantum academic programs nationwide, supporting quantum research institutes, centers, and programs, and integrating quantum research into private sector endeavors.³⁶ The roundtable gathered leaders from across the academic community, with representatives from women's colleges and HBCUs joining representatives from State-wide systems and private institutions to discuss efficient, original ways to innovate and mutually support QIS efforts. In August 2020, the Administration, along with industry and academic leaders, launched the National Q-12 Education Partnership to expand access to quantum education at the K-12 level.³⁷

In October 2020, NSF and OSTP hosted a Q-12 kick-off meeting to highlight the initiative, discuss quantum information science education, and provide information on the partnership to stakeholders across academia, government, industry, professional societies, and K-12 education. A working session of the partnership allowed participants to exchange ideas, share information on current activities, and discuss goals.



Caption: President Donald J. Trump listens as FCC Chairman Ajit Pai delivers remarks on U.S. 5G deployment technology on Friday, April 12, 2019, in The White House.

Credit: Official White House Photo by Tia Dufour

Advanced Communications Networks & 5G

“Secure 5G networks will absolutely be a vital link to America’s prosperity and national security in the 21st Century.”

Donald J. Trump, President of the United States

There is a common thread that unites the future of agriculture, manufacturing, small business, education, and healthcare: every advance requires robust internet connectivity. The Trump Administration is committed to ensuring every American can participate in the 21st Century economy by expanding and improving access to high-speed broadband networks. Throughout the first term, the Administration has taken action to expedite the buildout of broadband internet in rural communities and streamline the deployment of secure 5G networks.

HIGHLIGHTS INCLUDE:

Funding Rural Broadband Access

Since its launch in 2018, the U.S. Department of Agriculture (USDA) ReConnect Program has awarded nearly \$750 million to support over 80 projects, which will benefit more than 430,000 rural residents in 34 States.³⁸ Across all of its rural broadband loans and grants programs, USDA has awarded \$1.82 billion since 2017. The Federal Communications Commission (FCC) launched a new \$20.4 billion Rural Digital Opportunity Fund, the FCC’s biggest step yet to close the digital divide. The FCC estimates 5.3 million rural homes and businesses located in areas where 10.25 million unserved Americans live and work could benefit from the \$16-billion Phase 1 of the program. The Rural Digital Opportunity Fund builds on the success of the Commission’s 2018 Connect America Fund Phase II auction,³⁹ which awarded \$1.49 billion to provide broadband to more than 700,000 unserved homes and small businesses in 45 states. The Commission also established a \$9 billion 5G Fund for Rural America to ensure that rural communities see the benefits of next-generation wireless connectivity.

Establishing the American Broadband Initiative

The American Broadband Initiative (ABI) was launched in February 2019 with the release of its Milestones Report.⁴⁰ ABI is the Administration's strategy to increase access to rural broadband by removing barriers to investment and deployment of rural networks. ABI is driving change across the Federal Government in three key ways: 1) streamlining Federal permitting, 2) better leveraging of Federal assets that can be used for communications infrastructure, and 3) maximizing the effect of Federal funding to better target taxpayer dollars. More than 20 Federal agencies are involved with ABI, and The White House coordinates their efforts. In March 2020, GSA released a common form for industry to request access for building broadband and 5G infrastructure on Federal property, streamlining the process and significantly reducing the time to get permitting decisions.⁴¹ ABI builds on two Executive actions signed in January 2018⁴² and continues to make significant progress towards increasing access to rural broadband.⁴³ In addition, the FCC adopted two orders that lower costs and streamline the permitting processes for 5G infrastructure, as well as an order that streamlines the deployment of fiber.

Accelerating U.S. Leadership in 5G Spectrum

Advanced wireless communications networks rely on spectrum. To that end, the FCC has developed a comprehensive strategy to "Facilitate America's Superiority in 5G Technology" (the "5G FAST Plan"),⁴⁴ which includes pushing more spectrum into the marketplace. The FCC concluded three high-band spectrum auctions receiving over \$10 billion in bids in these auctions.⁴⁵ These auctions have made 4,950 megahertz of millimeter-wave spectrum available for next-generation wireless services such as 5G. As a result, the United States currently leads the world in allocation and use of high-band spectrum. This spectrum provides incredibly fast speeds, low latency, and device density.

In August, the FCC also concluded its first-ever mid-band 5G spectrum auction, auctioning 70 megahertz in the 3550-3650 MHz band and raising over \$4.5 billion. The larger 150 megahertz of spectrum in the 3550-3700 MHz band is currently available for opportunistic "general authorized access" use. The existing equipment ecosystem for the band will allow winning bidders to quickly deploy services using this spectrum shortly after receiving their licenses. The agency will hold another mid-band auction for 280 megahertz of spectrum in the 3700-3980 MHz band in December. Furthermore, the FCC has two mid-band auctions, including for the 3450-3550 MHz band, planned for next year. Combined, the FCC's actions will place a 530-megahertz swath of contiguous spectrum from 3450 MHz to 3980 MHz into the 5G pipeline.

On low-band spectrum, the FCC completed the multi-year transition process for broadcast television stations to relocate to new channels outside of the 600 MHz band. The FCC previously auctioned 70 megahertz of 600 MHz band spectrum for next-generation services, and this spectrum is now used to provide 5G network coverage to more than 250 million Americans.

The FCC also opened up 1200 megahertz of mid-band spectrum in the 6 GHz band for unlicensed use, including Wi-Fi, and the Commission modernized the rules for the 4.9 GHz band to allow states to use the spectrum to support their particular connectivity needs, including rural broadband, critical infrastructure, and public safety.

Improving Advanced Communications for All Americans: 5G Mid-Band Spectrum

In August 2020, The White House and DoD [announced](#) that 100 megahertz (MHz) of contiguous mid-band spectrum in the 3450-3550 MHz band will be available for 5G.

OSTP initiated and worked with the DoD and DoD Service branches, the FCC, and the National Telecommunications and Information Administration to make available a valuable portion of mid-band spectrum without encumbrances while protecting critical security requirements.

In September 2020, the FCC [adopted](#) proposed rules for making the 3450-3550 MHz band available for commercial use, with the goal of conducting an auction for the spectrum in December 2021. The Administration is committed to working closely with industry to ensure timely access to the band while protecting national security.

Protecting America's Networks: National Strategy to Secure 5G

In March 2020, President Trump signed the "Secure 5G and Beyond Act"⁴⁶ into law. The first deliverable was the "National Strategy to Secure 5G,"⁴⁷ which the Administration delivered in March 2020. The goal of the strategy is for America to lead the development, deployment, and management of secure and reliable 5G communications infrastructure worldwide. This will be conducted arm-in-arm with our closest partners and allies, and will include facilitating domestic 5G rollout, assessing the risks and identifying core security principles for 5G infrastructure, managing risks to our economic and national security from the use of 5G infrastructure; and promoting responsible global development and deployment of 5G infrastructure.

Protecting America’s Networks with Supply Chain Cybersecurity

The Trump Administration continues to prioritize safe and secure 5G networks. In May 2019, President Trump signed an Executive Order banning the use of Information and Communications Technology (ICT) and services from vendors that are subject to adversarial government influence and that pose an undue risk to the Nation.⁴⁸ In addition, the FCC passed the “Universal Service Fund Supply Chain Order,”⁴⁹ notifying recipients of FCC Federal funds they may not use such funds to buy banned equipment and further explores the removal of such equipment. The Trump Administration also participated in the development of “The Prague Proposals,”⁵⁰ a series of 5G policy, technology, economy, and security recommendations for nations to consider as they design, construct, and administer their 5G infrastructure, including evaluating 5G equipment and services suppliers for specific risk characteristics.

Prioritizing R&D in Wireless Communications

In May 2019, OSTP published the report, “Research and Development Priorities for American Leadership in Wireless Communications.”⁵¹ Efficient spectrum use and spectrum availability are fundamental to the Nation’s security and prosperity, requiring a “whole-spectrum solution” that encompasses and addresses scientific research, technology, policy, legislation, operations, and economics. This report identified three R&D priorities: improve spectrum flexibility, improve spectrum awareness, and improve efficiency and effectiveness through the use of AI.

One milestone was the continued growth of the Platforms for Advanced Wireless Research (PAWR) program at NSF—a \$100 million public-private partnership to establish national resources for researchers.⁵² PAWR’s successes include the activation of the Platform for Open Wireless Data-driven Experimental Research (POWDER) facility in Salt Lake City in November 2019. The Cloud Enhanced Open Software-Defined Mobile Wireless Testbed (COSMOS) facility in Harlem, New York started its pilot deployment in May 2019.⁵³

In September 2019, NSF announced its third PAWR testbed—the Aerial Experimentation and Research Platform for Advanced Wireless (AERPAW).⁵⁴ Based in North Carolina, AERPAW is focusing on communications for unmanned aerial systems. In July 2020, NSF announced planning grants for a rural broadband testbed in Nebraska and Iowa. Lastly, in August 2020, NSF awarded the initial planning grants for the Spectrum Innovation Initiative Center. This is a \$30 million program to create a multi-university center of excellence in spectrum innovation research.

Given the close coupling of AI and 5G, two of the seven themes in the above mentioned NSF National AI Research

Institutes program focus on cyberinfrastructure and computer networks and systems.

DoD Technology Transfer

Another milestone was the successful completion of the DARPA Spectrum Collaboration Challenge (SC2), with winners announced in October 2019.⁵⁵ In addition to advancing the state of the wireless art, the SC2 created the largest supercomputer specialized for wireless research. In November 2019, DARPA transferred the supercomputer to Northeastern University as part of the PAWR program for use as a national resource for researchers. In 2020, DoD awarded over \$600 million in contracts for advanced 5G development to deploy advanced applications such as automated warehouses, vehicle maintenance, AR/VR for training, and spectrum sharing in hostile environments.⁵⁶ These testbeds will provide critical information to DoD, as well as create markets for the private sector, as these applications are applicable to all enterprises, not just defense.

Advanced Manufacturing

“Through clear-eyed economic and trade policies and advances made possible by cutting-edge research and development, American industry is thriving once again. Today, our country’s manufacturers are more confident than ever before about investing in factories and workers right here at home.”

Donald J. Trump, President of the United States

Throughout his first term, President Trump has prioritized national security and economic prosperity through leadership in advanced manufacturing. In the midst of intense and growing global competition, The White House unveiled the “National Strategic Plan on Advanced Manufacturing” in October 2018.⁵⁷ The strategy focuses on defending the economy, expanding manufacturing employment, and ensuring a strong manufacturing and defense industrial base and a resilient supply chain. The aim is to secure U.S. global leadership in advanced manufacturing by connecting people, ideas, and technology. Through Manufacturing USA Institutes, business competitors, academic institutions, and other stakeholders are working together to test applications of new technology, create new products, and reduce cost and risk, as well as enabling a workforce with the skills of the future so that we can ensure that what is created here is made here by a well-trained American workforce.

Advancing Manufacturing Skills in the Workforce

From providing training for veterans to advancing technologies developed in the National Labs, the Federal network of Manufacturing USA institutes convened stakeholders across the manufacturing community to address the Nation's pressing manufacturing technology and competitiveness needs. Through 2018, the institutes engaged more than 1,300 member organizations, sponsored more than 270 R&D projects, attracted more than \$2 billion in private investment leveraging \$1 billion in Federal funds, and equipped more than 200,000 people with advanced manufacturing skills needed to pursue high-paying jobs.⁵⁸

Driving Advancements to Realize the Potential of Additive Manufacturing

The DOE Manufacturing Demonstration Facility (MDF) at Oak Ridge National Laboratory (ORNL) has hosted over 25,000 visitors in pursuit of state-of-the-art additive manufacturing technologies. Through over 130 Cooperative Research and Development Agreements, MDF collaborates with industry to develop advanced additive systems. Over 35 systems, totaling more than \$12 million—with \$7 million in systems awaiting arrival—are in use at the MDF today.

Securing the Supply Chain for Critical Materials and Resources for Advanced Manufacturing

Access to critical minerals is important to the development and manufacturing of many advanced technologies, and the Administration has made securing critical mineral supply chains, particularly rare earth materials, a priority. The Administration has directly addressed supply chain vulnerabilities for rare earth separation as well as neodymium iron boron rare earth permanent magnets production through Executive Orders and several Presidential Determinations. In addition, the Trump Administration is working to establish domestic capacity for rare earth and other metal and metal alloy production. The ecosystems for rare earth materials—which are critical to U.S. economic and national security interests—are now taking shape, including a potential supply chain for aluminum-scandium alloys that are critical for automotive and aerospace applications.

Advanced Manufacturing and COVID-19

Through funding from DoD and NIST, the United States has mobilized several Advanced Manufacturing Institutes to develop tools and technologies to help fight the coronavirus pandemic through improvements in supply chain management and developing new, scalable manufacturing systems. Examples of these efforts are described in the "[Health Security and Innovation](#)" section of this report.

Biotechnology

"The American spirit of discovery has emboldened scientific pioneers across sectors to integrate biology with an amazing diversity of other fields, from manufacturing to computer science, driving biotechnology forward."

Donald J. Trump, President of the United States

The Trump Administration recognizes the boundless applications of biotechnology to support economic growth, national security, healthcare, manufacturing, and agriculture. To foster an environment of growth in this emerging field, the Trump Administration is reducing unnecessary regulations, breaking down barriers to entry into the market place, and improving global competitiveness. For additional health related S&T advancements, including COVID-19-related highlights, see the next section on "[Health Security and Innovation](#)."

HIGHLIGHTS INCLUDE:

Modernizing Regulations for Biotechnology

In June 2019, President Trump signed an Executive Order to update and modernize the regulatory approval process for agricultural biotechnology products.⁵⁹ Biotechnology innovations can help the Nation meet its food production needs, raise the productivity of the American farmer, improve crop and animal characteristics, increase the nutritional value of crop and animal products, and enhance food safety. To realize these potential benefits, the United States must employ a science-based regulatory system that evaluates products based on human health and safety and potential benefits and minimal risk to the environment. At the same time, the United States will continue its efforts to enhance America's competitive advantage created through our innovation and biotechnological leadership to ensure our economic prosperity and security.

Promoting Collaboration to Strengthen the American Bioeconomy

In October 2019, The White House hosted the Summit on America's Bioeconomy, bringing together Federal Government, industry, and academia to emphasize this critical sector's role as an Industry of the Future and a national strategic R&D priority.⁶⁰ This event highlighted the Administration's determination to drive innovation and economic growth by promoting and safeguarding critical



Caption: President Donald J. Trump is joined by Agriculture Secretary Sonny Perdue, Iowa Governor Kim Reynolds, members of Future Farmers of America, and local officials to sign an Executive Order on “Modernizing the Regulatory Framework for Agricultural Biotechnology Products” on June 11, 2019.

Credit: Official White House Photo by Shealah Craighead

bioeconomy infrastructure and data; building the bioeconomy workforce of the future; leveraging the entire U.S. innovation ecosystem; and identifying regulatory opportunities and challenges. OSTP issued a Request for Information (RFI) to help identify gaps, vulnerabilities, and opportunities within the U.S. innovation bioeconomy ecosystem that may benefit from an enterprise perspective and Federal Government attention. In September 2020, NSTC established a new interagency Subcommittee on Bioeconomy S&T to improve coordination of Federally-supported R&D and transform U.S. technology capabilities across the American bioeconomy.

Enabling Data Analytics for Biology and the Environment

The DOE National Microbiome Data Collaborative (NMDC) was initiated in 2019 to develop an open-access capability for the analysis and interpretation of microbiome data for applications in energy, environment, health, and agriculture.⁶¹ The effort will leverage DOE’s high-performance computing systems to break through the existing bottleneck of genomics and environmental data. Capabilities provided by the NMDC will help address an Administration R&D priority to enable biotechnology, omics, scientific

collections, biosecurity, and data analytics to drive growth in multiple economic sectors.

Federal Agencies in Action: NSF Encouraging the Next Generation of Biotechnology Professionals

NSF [announced](#) its support for applicants to engage high school students in the International Genetically Engineering Machine (iGEM) competition. NSF made its second set of awards in Advanced Technological Education (ATE) focused on partnerships between grades 7–12, and 2-year Institutions of Higher Education in a number of areas including biotechnology. NSF continues to make awards that support biotechnology through the NSF Research Traineeship (NRT) Program. These are just a few examples of NSF’s support for the entry of the next generation of students into the bioeconomy workforce.

Enabled by IotF: Advanced Transportation

“Our Nation will move faster, fly higher, and soar proudly toward the next great chapter of American aviation.”

Donald J. Trump, President of the United States

American innovation and ingenuity have transformed numerous aspects of daily life, not the least of which is the ongoing revolution in how we travel and connect with one another. President Trump has stressed the importance of ensuring America's continued leadership in IotF and related critical and emerging technologies, including Automated Vehicles (AVs). AV innovation has positioned the United States to once again transform the future of transportation, driving economic prosperity, and making our airways and roadways safer. Whether it is commercial drones, automated vehicles, or supersonic aircraft, the Trump Administration has continued to explore smart regulatory pathways and increased testing and development to usher in the future of transportation.

HIGHLIGHTS INCLUDE:

Increasing Commercial Drone Operation Safety

In December 2019 the Federal Aviation Administration (FAA) issued a Notice of Proposed Rulemaking to require remote identification of unmanned aircraft systems (UAS).⁶² This rule is a critical step forward to integrate commercial unmanned aircraft into the National Airspace System (NAS) and addresses the security and safety aspects of expanding drone operations. Remote ID establishes the foundation for future Unmanned Traffic Management (UTM) technology and creates the framework for drones to operate beyond visual line of sight. Furthermore, Federal departments and agencies are working together to develop air domain awareness (ADA) along with detect and avoid (DAA) systems for commercial and government use. These are key features required to enable safe industry growth.

Expanding Innovative and Potentially Life-saving Commercial Drone Operations

Thanks to the Trump Administration's Drone Integration Pilot Program (IPP), the United States made historic advancements to expand commercial drone operations nationwide across many different sectors—from agriculture, to health care, to public safety. In October 2019, following testing and development through the IPP and with FAA authorization, UPS Flight Forward performed a historic,

first-ever commercial drone operation as a Part 135 Air Carrier. In partnership with the FAA, North Carolina Department of Transportation, and a local hospital, the UPS team now delivers medical samples for testing, saving precious time to get life-saving information. During its first certified flight, the UPS team was proud to have an all-woman crew operating their aircraft.

Advancing Civilian Supersonic Aircraft Technology

The Administration is continuing to advance civilian supersonic aircraft technology. In July 2019, the FAA issued a new proposed rule to modernize the procedure to test supersonic civilian aircraft, relieving a burdensome regulatory hurdle.⁶³ NASA made significant progress with its latest manned X plane. The X-59 Quiet SuperSonic Technology (QuesST) aircraft was cleared for final assembly and systems integration.⁶⁴ The QuesST's unique shape is designed to reduce the “thump” heard when breaking the sound barrier. The data gained from the X-59 will provide policymakers the information required to establish a new commercial supersonic noise standard and eventually lift the ban on supersonic flight over land.⁶⁵



Caption: U.S. CTO Michael Kratsios visits the Drone Integration Pilot Program site in Choctaw, OK.

Credit: OSTP

Enabling Advanced Air Mobility

Advanced aerial mobility marks what some describe as the third revolution in aerospace. This technology is characterized by the coalescence of autonomy, light electrical power systems, and advanced computing, manufacturing, and communication. This innovation in air vehicle design could enable missions in urban and other environments that are currently conducted by ground vehicles. Electric propulsion and increasingly automated flight may also improve safety, simplify maintenance and operation, lower noise and improve ease of use.⁶⁶ To enable this transformation, NASA has launched their “National Campaign” (formerly “Grand Challenge”) bringing industry



Caption: Summit, an IBM AC922 system supercomputer, links more than 27,000 NVIDIA Volta graphics processing units with more than 9,000 IBM Power9 central processing units to provide unparalleled opportunities in integrating AI and scientific discovery.

Credit: ORNL

together for flight procedures and airspace control architecture.⁶⁷ Complementing NASA, the U.S. Air Force launched Agility Prime focusing on operationalizing electric vertical take-off and landing aircraft or “ORBs” for manned and unmanned flight.⁶⁸ With over 15 small businesses seeking to fly in the program, over \$100 million of government investment, and over 200 R&D contracts to small businesses and universities all in the first year, it seeks to accelerate commercial investment in this sector. Early government adoption could quickly create a robust domestic market that ensures American aerospace dominance while maturing the safety and security of a new generation of mobility.

Continued Testing for the Safe Integration of Automated Vehicles

In September 2019, the U.S. Department of Transportation (USDOT) announced \$60 million in Federal grant funding⁶⁹ to selected award recipients to test the safe integration of automated driving systems on our Nation’s roadways. These grants will gather significant safety data to inform rulemaking and foster collaboration among State and local governments and private partners. The funding will be distributed to eight projects across seven States.

Enabling IoT: Future Advanced Computing Ecosystem

The United States is pioneering the future of computing to address the S&T challenges and opportunities of the 21st Century. The Trump Administration continues to drive American leadership in the future advanced computing ecosystem through an increased focus on research and development, a broadening of the Nation’s computational infrastructure, and an expansion of partnerships across government, industry, and academia.

Leading the World in Supercomputing

America continues to lead the world in high performance computing. Two of the four fastest supercomputers in the world reside at the DOE’s incredible National Laboratories—Summit at ORNL and Sierra at Lawrence Livermore National Lab. Overall, four of the top ten fastest supercomputers are in the United States, including the NSF-funded Frontera system at the University of Texas at Austin.

Updating the National Strategic Computing Initiative

In response to the evolving landscape for high performance computing, the Trump Administration updated the Nation’s strategic approach to the future of computing technologies and applications.⁷⁰ Using feedback from an RFI and a two-

day community of interest meeting, the new plan refocuses efforts on computing beyond the exascale effort, with an emphasis on supporting the software and workforce ecosystems around the future of computing. Additional modifications to the first “National Strategic Computing Initiative Strategic Plan” (2016) include engagement with emerging heterogeneous systems, deeper investment in support for infrastructure including data and architectures, and inclusion of cybersecurity recommendations for the high-performance computing community. Overall, the update promises to enable the future advanced computing ecosystem to ensure American leadership in science, technology, and innovation.

Using High Performance Computers for Health Care

A collaboration between the DOE and the National Institutes of Health (NIH) National Cancer Institute (NCI) is accelerating the ability to derive knowledge from big data in cancer research. This is laying the foundation for the development of computational predictive models and simulations across the continuum of cancer, further strengthening the vision for precision oncology.⁷¹ This work produced an AI application that was nominated for best paper at the 2019 Supercomputing Conference, with results to be published in the journal *Science*.⁷² The application involved multiscale simulation on predictively modeling the dynamics of Ras proteins—a family of proteins whose mutations are linked to more than 30 percent of all human cancers—and their interactions with lipids, an important component of cell membranes.

Achieving the First Exascale Systems

DOE announced it would deploy two exascale High Performance Computing (HPC) systems in 2021 and 2022.⁷³ In preparation, the DOE's Exascale Computing Project (ECP) is working towards the delivery and deployment of exascale software technologies.⁷⁴ Meanwhile, its Summit supercomputer, the second fastest supercomputer in the world as of June 2020,⁷⁵ helped demonstrate quantum supremacy in a landmark effort with industry and NASA.⁷⁶

Supporting the Nation's S&T Research and Workforce

In 2019, NSF officially launched Frontera—currently the 8th fastest computer in the world and the fastest academic supercomputer.⁷⁷ NSF has begun the conceptual design of its Phase 2 computing facility, which will bring a 10-fold performance increase over Frontera. NSF has also awarded approximately \$60 million to fund advanced computing efforts supporting research in training in science and high-performance analytics.

Harnessing Advanced Computing to Fight COVID-19

The White House, in partnerships with the DOE, NSF, and IBM, launched the COVID-19 HPC Consortium⁷⁸ to help accelerate the pace of scientific discovery in the fight to stop the virus. Details about the HPC Consortium and other activities aimed at combating the COVID-19 pandemic are described below in the “[Health Security and Innovation](#)” section.

HEALTH SECURITY AND INNOVATION

“The knowledge and technologies brought to bear in the fight against COVID-19 will serve as the new foundation for the Nation’s response to whatever challenge may come next, giving us extraordinary innovations and discoveries that will provide the capabilities needed to maintain the health, safety, and security of our Nation.”

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

Strengthening and safeguarding the health and quality of life of individuals, families, and communities has been a consistent priority for the Trump Administration. The COVID-19 pandemic has highlighted the extent to which public health threats and challenges can affect economic and national security while disrupting every aspect of our daily lives. The Administration is committed to focusing on policies, R&D investments, and whole-of-Nation initiatives that improve health now and in the future while building an economy that optimizes innovation to benefit the American people.

An S&T Enterprise-wide Fight Against COVID-19

SARS-CoV2 and COVID-19 represent a generational challenge that can only be addressed through a whole-of-society approach. Since the start of the pandemic, President Trump has prioritized enabling and empowering industry, government, academia, and nonprofits to coordinate, collaborate, and partner to leverage resources and share expertise, data, knowledge, technology, and infrastructure to battle this “invisible enemy.”

HIGHLIGHTS INCLUDE:

Providing Critical Support for R&D and Related Activities

Science is one of the strongest weapons that we have against this virus, which is why President Trump has enlisted our unrivaled research community in the fight. Since the start of the pandemic, the Administration has taken several actions to engage scientists in academia, industry, and government to understand and defeat this disease. In early March 2020, the President signed into law the “Coronavirus Preparedness and Response Supplemental Appropriations Act,” which provided over \$800 million dollars to NIH to accelerate vaccine efforts.⁷⁹

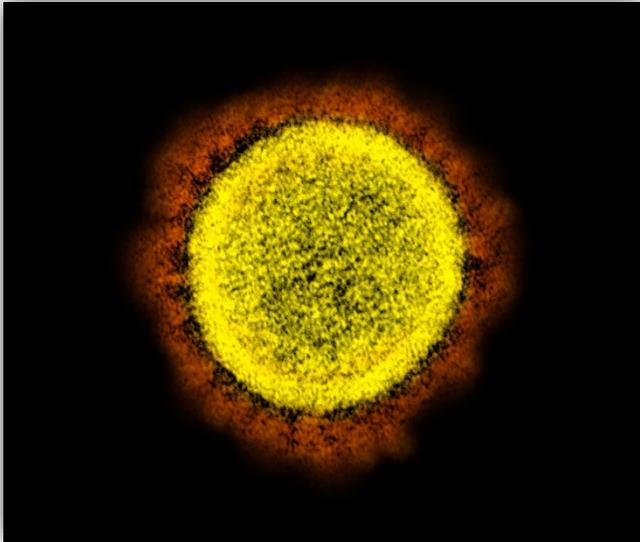
Later in March, President Trump signed the “Coronavirus Aid, Relief, and Economic Security (CARES) Act.”⁸⁰ The law provided another round of additional funding for NIH (\$945 million) and other science agencies to support the Federal response, including:⁸¹

- ❖ \$415 million for DoD activities, including development of vaccines, anti-viral drugs, and diagnostic tests.
- ❖ \$99.5 million for the DOE in support of access to DOE scientific user facilities.
- ❖ \$75 million for NSF.
- ❖ \$66 million for NIST, including \$10 million for the National Institute for Innovation in Manufacturing Biopharmaceuticals and \$6 million for viral testing and biomanufacturing measurement.
- ❖ \$2.25 million for the Environmental Protection Agency (EPA) to support research into environmental transmission of SARS-CoV2 via contaminated surfaces or materials.

On April 24, 2020, President Trump signed the “Paycheck Protection Program and Health Care Enhancement Act.”⁸² The Act provided:

- ❖ \$1.8 billion to NIH to develop, validate, improve, and implement testing and associated technologies; to accelerate research, development, and implementation of point-of-care and other rapid testing; and for partnerships with governmental and non-governmental entities to research, develop, and implement the activities; and

- ❖ \$1 billion to the Biomedical Advanced Development Authority (BARDA) for advanced research, development, manufacturing, production, and purchase of diagnostic, serologic, or other COVID-19 tests or related supplies.



Caption: Transmission electron micrograph of SARS-CoV-2 virus particles, isolated from a patient. Captured at the NIAID Integrated Research Facility in Fort Detrick, MD.

Credit: National Institute of Allergy and Infectious Diseases, NIH

Operation Warp Speed

President Trump initiated Operation Warp Speed (OWS) as part of a broader strategy to accelerate the development, manufacturing, and distribution of therapeutics and vaccines to combat COVID-19—all without compromising ethics, accountability, or safety. OWS is a partnership among components of the Department of Health and Human Services (HHS)—including the Centers for Disease Control and Prevention (CDC), NIH, and BARDA—and DoD, with the support of numerous Federal departments and agencies.⁸³ OWS aims to bring together government with industry and other stakeholders to deliver significant quantities of safe and effective countermeasures for COVID-19. The need for a vaccine led the Administration to support an unprecedented synchronized development process over the more traditional sequential approach.

These parallel development activities seek to balance risk and benefit by enabling initial production at the time of approval, rather than building up production capacity after approval, a process that normally takes years to complete from start to finish. OWS has three components:⁸⁴

- ❖ **Vaccine development:** HHS announced incremental funding from March through August in support of vaccine production across industry, reflecting a variety of platform approaches to a much-needed public-health

solution. The funding agreements intend to make one or more vaccines available for the United States as early as fall 2020. To date, several Phase 3 studies are already underway, with tens of thousands of participating volunteers.⁸⁵

- ❖ **Manufacturing:** From May through August 2020, HHS announced a number of task orders⁸⁶ to advance domestic manufacturing capabilities for a potential COVID-19 vaccine and therapeutics, totaling hundreds of millions of dollars.
- ❖ **Distribution:** Between May and September 2020, HHS and DoD announced a joint effort to increase domestic manufacturing capacity for and distribution of prefilled syringes and vials that may be needed for vaccines and treatments.

High Performance Computing Consortium

“Under the Trump Administration, the United States has regained its position as the dominant global force in Supercomputing technology. The Department of Energy is home to the world’s fastest and most powerful supercomputers, and we are excited to partner with leaders across the scientific community who will use our world class innovation and technology to combat COVID-19.”

Dan Brouillette, Secretary, U.S. Department of Energy

On March 23, 2020, The White House announced the launch of the COVID-19 HPC Consortium⁸⁷ to provide COVID-19 researchers worldwide with access to the world’s most powerful high performance computing resources that can significantly advance the pace of scientific discovery in the fight to stop the virus. This unique public-private consortium, spearheaded by The White House, DOE, NSF, and IBM, includes government, industry, and academic leaders who have volunteered free compute time and resources on their machines. Researchers from every sector are matched with computing resources from one of the partner institutions. The sophisticated computing systems available through this Consortium can process massive numbers of calculations related to bioinformatics, epidemiology, and molecular modeling, helping scientists answer complex scientific questions about COVID-19 in hours or days instead of weeks or months. To date, the consortium includes 43 members (with 7 international partners) aggregating approximately 600 Petaflops of computing power, and has supported over 90 projects as of October 2020.

Supporting the Fight Against COVID-19 with Advanced Manufacturing

With the support of NIST and DoD, several Advanced Manufacturing Institutes are developing tools and technologies to help fight the coronavirus pandemic through improvements in supply chain management and developing new, scalable manufacturing systems, new therapies, treatments, and drugs. Examples include:

- ❖ **National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL)**: NIIMBL is applying innovations in biopharma to the challenges of the pandemic by identifying and enhancing reliable domestic supply chains for testing and production of respirators and personal protective equipment (PPE), developing flexible manufacturing capabilities, validating approaches for rapid sanitization of clinical spaces, developing contact tracing technology for essential workers in pharmaceutical manufacturing facilities, and building flexible manufacturing capabilities that allow quick scale-up of the production of biologic therapies and essential medical products.
- ❖ **BioFabUSA “Demand Forecasting Dashboard”**: BioFabUSA is developing a roadmap for pandemic response and recovery. The roadmap will identify and prioritize critical needs including: supply chain issues to enable increased production of personal protective equipment, test kits, and vaccines through acceleration in manufacturing production of vaccines and rapid delivery of resources to key locations.
- ❖ **AIM Photonics “Rapid Photonic Point-of-Care or Clinical COVID-19 Diagnostic”**: This institute project will support manufacturing development and testing of a new disposable photonic COVID-19 antibody test. Combined with a commercial high-volume clinical analyzer, this will result in a functional point-of-care test within facilities like hospitals that currently own these existing analyzers.
- ❖ **BioFabUSA “Novel Drug Delivery System”**: Deliver lifesaving vaccines or drugs via mail, enabling U.S. citizens to accurately administer vaccines or drugs to themselves. The project will develop a new drug delivery platform with: (1) microneedle technology, (2) an easy manufacture/fill reservoir for vaccines/drugs, and (3) an actuation method for administration according to protocol. Initial focus is intradermal administration of COVID vaccines.
- ❖ **BioFabUSA “High-Dimensional Design of Experiments (HD-DOE)-Based Identification of Efficacious Antiviral Combinations Against Acute Pulmonary Infections by COVID-19”**: This institute project will use an HD-DOE approach to conduct functional assays (e.g., viral titer, cell viability) with

combinations of more than 300 antiviral drugs to help identify a clinically potent antiviral combination against COVID-19.

- ❖ **America Makes “Pandemic Additive Manufacturing Design Innovation Program”**: This institute project is connecting the additive manufacturing industry with the medical care provider community, working closely with VA, to accelerate design and clinical review of 3D-printed PPE medical devices currently in short supply.
- ❖ **Manufacturing x Digital (MxD) “Capacity and Mobilization Assessment of Pharmaceutical Industry Utilizing Digital Technologies to Optimize Scale-Up Production”**: This institute project will work to better understand supply-chain and production gaps in our pharmaceutical industry and demonstrate how advanced digital design and manufacturing technologies can expand U.S. pharmaceutical manufacturing capacity.

Federal Agencies in Action: NIH Expanding COVID-19 Testing for Underserved Communities

In September 2020, [NIH awarded](#) nearly \$234 million to improve COVID-19 testing for underserved and vulnerable populations. The RADx Underserved Populations (RADx-UP) program will support 32 institutions across the Nation, focusing on populations disproportionately affected by the pandemic. These groups include African Americans, American Indians/Alaskan Natives, Latinx, Native Hawaiians, older adults, pregnant women and those who are homeless or incarcerated.

Among the goals of the program is to develop strategies to reduce disparities in COVID-19 testing. To accomplish these goals in rapid fashion, the RADx-UP program is supporting projects with established community partnerships that can use their existing research infrastructures to swiftly implement strategies and interventions to increase access and uptake of COVID-19 testing among target populations.

Furthering International Engagement

Since the start of the pandemic, The White House has worked with the international community to leverage knowledge and resources in the fight against COVID-19. For example, in March 2020, OSTP initiated weekly calls with global science leaders including science ministers and chief science advisors to share information on integrating science into the COVID-19 response.⁸⁸

Leveraging Data in the Fight Against COVID-19

Improving data access, discoverability, and usability has been a key priority of the Trump Administration since day one. The President's Management Agenda, Federal Data Strategy, and NSTC Subcommittee on Open Science have contributed to making information and data available in a way that respects security and privacy. These initiatives combined with S&T R&D investments have improved our ability to use massive amounts of information to advance discovery and innovation, inform decision-making, and improve U.S. Government services.

No better example of the importance of data exists than in the fight against COVID-19. In a pandemic, every moment counts; scientists, health professionals, and the public urgently need access to data and information, often in near real-time. The Administration has taken additional actions to maximally leverage data during the pandemic.

- ❖ In March 2020, OSTP led a group of 16 countries in [issuing a call](#) to the scholarly publications community to voluntarily make their COVID-19 and coronavirus-related publications, and the available data supporting them, immediately accessible in public repositories to support emergency response efforts. The countries urged publishers to make the information available in human and machine-readable formats to allow for full text and data mining using AI with rights accorded for research re-use and secondary analysis.
- ❖ At the same time, [The White House led](#) a group of top researchers and leaders from the Allen Institute for AI, Chan Zuckerberg Initiative, Georgetown University's Center for Security and Emerging Technology, Microsoft, and NIH to release the COVID-19 Open Research Dataset (CORD-19) of scholarly literature about COVID-19, SARS-CoV2, and the coronavirus family. The dataset represents the most extensive machine-readable coronavirus literature collection available for data and text mining to date. Following the release of CORD-19, the Administration issued a call to action to the Nation's AI community to develop new text and data mining techniques that can help the science community answer high-priority scientific questions related to COVID-19.
- ❖ Under President Trump's leadership, Federal departments and agencies are gathering and making available COVID-19-related data. For example, the [HHS Protect Public Data Hub](#) provides high-quality, accessible, and timely information for entrepreneurs, researchers, and policy makers to help drive insights and better health outcomes for all. This site augments Healthdata.gov with non-government datasets from academia, non-profit organizations, industry, hospitals, and facilities reporting from all 50 states and U.S. territories. HHS Protect also provides predictive outcome capabilities through AI, which informs predictions on the locations of outbreaks and decision-making about distributing supplies.

In May 2020, OSTP hosted a virtual meeting of the G7 S&T Ministers to collaborate on COVID-19 response and recovery. The G7 S&T Ministers emerged with a declaration,⁸⁹ expressing their intent to:

- ❖ Strengthen the use of HPC for COVID-19 response and enhance cooperation on ongoing initiatives, such as the COVID-19 HPC Consortium, the Partnership for Advanced Computing in Europe (PRACE), and the High Performance Computing Infrastructure in Japan.
- ❖ Make government-sponsored COVID-19 epidemiological and related research data and information accessible to the public in machine-readable formats, to the extent possible.
- ❖ Exchange best practices to advance broadband connectivity; minimize workforce disruptions, support distance learning and working; enable access to smart health systems, virtual care, and telehealth services; promote job upskilling and reskilling programs to prepare the workforce; and support global social and economic recovery, in an inclusive manner while promoting data protection, privacy, and security.
- ❖ Enhance cooperation on shared COVID-19 research priority areas.

- ❖ Launch GPAI (described [above](#)) to enhance multi-stakeholder cooperation to advance AI in a manner that reflects shared democratic values, with an initial focus on COVID-19.

Preparing for Biological Threats

Even before the start of the pandemic, the Administration took steps to prepare for and mitigate biological threats. For example, in the fall of 2019, the President signed an Executive Order to modernize the vaccine approach to counter influenza.⁹⁰ The Executive Order encouraged public-private partnerships to strengthen and diversify vaccine development, manufacturing, and supply chain; promote innovative technological approaches for detecting, preventing, and treating influenza; and increase vaccine access and coverage regulations. Under the President's watch, BARDA achieved a historic milestone in global health security with the approval of ERVEBO, the first FDA-approved vaccine for the prevention of the Ebola virus disease.⁹¹



Caption: OSTP Director Kelvin Droegemeier joins the Biodefense Steering Committee in support of the 2018 National Biodefense Strategy at The White House in September 2020.

Credit: Official White House Photo by Tia Dufour

Today, the Trump Administration is continuing its response not only to the pandemic, but also preparing for future biological threats. In the FY 2022 R&D Budget Priorities Memorandum,⁹² The White House highlighted “Health Security and Innovation,” and designated infectious disease modeling, prediction, and forecasting as a top R&D priority. R&D in this area will enhance our ability to predict future pandemics by continuing to advance data and forecasting science to inform a more streamlined, better coordinated, and continual whole-of-society approach to addressing future infectious disease outbreaks.

As a first step in executing this R&D priority, NSF, CDC, and the Intelligence Advanced Research Projects Activity (IARPA)—in coordination with OSTP—are actively engaging with stakeholders on the science and technology of epidemiological modeling and prediction. The goal of these efforts are to maximize America’s ability to respond to infectious disease outbreaks as well as threats posed by the intentional release of biological agents, with a focus on improving capacity and capability in epidemiological modeling and prediction.

Combating the Opioid Epidemic

“My administration is determined to use every resource at our disposal to smash the grip of addiction. In October 2017, my administration declared a nationwide public health emergency, directing agencies to use every resource in their arsenal to overcome the deadly plague of opioid abuse.”

President Donald J. Trump, President of the United States

The opioid crisis has had devastating effects on communities across the United States. The Trump Administration recognizes that S&T is an important facet of a comprehensive approach to combatting the epidemic and has taken strong action to address the situation.

HIGHLIGHTS INCLUDE:

Addressing Critical Gaps in R&D for Opioids

In April 2019, as part of the strategy to combat America’s crisis of addiction, NIH funded the \$350 million multi-year HEALing Communities Study to reduce opioid related



Caption: OSTP Director Kelvin Droegemeier participates in a meeting of The White House Task Force on Veteran Suicide in October 2019.
Credit: Alvin Williams, VA

deaths by 40 percent over three years and generate a blueprint for communities to follow nationwide.⁹³ In October 2019, The White House released the report “Health R&D to Stem the Opioid Crisis: A National Roadmap.”⁹⁴ The *National Roadmap* supports President Trump’s response to the opioid crisis by providing a framework for the next chapter in combating opioid addiction and identifying opportunities to improve coordination of Federal R&D essential to combating the opioid crisis.⁹⁵

Reducing the Lives Lost to Opioid Overdose

The Trump Administration announced \$1.8 billion in funding for States and territories to expand access to treatment and support real-time data through work by CDC and the Substance Abuse and Mental Health Services Administration (SAMHSA) in September.⁹⁶ These funds provide additional support on top of \$400 million in funding through the Health Resources and Services Administration (HRSA) to help community health centers, rural organizations, and academic institutions establish and expand access to substance abuse and mental health services in August.⁹⁷

In October 2019, SAMHSA launched FindTreatment.gov, a newly designed website that helps connect Americans looking for substance abuse treatment with approximately

13,000 locations across the United States and its territories.⁹⁸ In 2019, estimates suggested 1.27 million Americans received medication-assisted treatment, a 38 percent increase from an estimated 921,000 Americans in 2016.

Improving the Health of U.S. Military Veterans

“We will not rest until all of America’s great Veterans receive the care they’ve earned through their incredible service and sacrifice to our country.”

Donald J. Trump, President of the United States

HIGHLIGHTS INCLUDE:

Addressing Veteran Suicide

In March 2019, President Trump signed an Executive Order on the President’s Roadmap to Empower Veterans and End a National Tragedy of Suicide—the PREVENTS initiative.⁹⁹ The Executive Order established a task force comprising numerous White House offices and Executive Branch departments and agencies.¹⁰⁰ In September 2019, The White House hosted a summit on “Veteran Suicide: Translating



Caption: President Donald J. Trump signs an Executive Order for a “National Roadmap to Empower Veterans and End a National Tragedy of Suicide” (PREVENTS).

Credit: Official White House Photo by Joyce N. Boghosian

Research Innovation into Public Health Solutions.” The summit brought together over 125 researchers, clinicians, innovators, and decision-makers from inside and outside of government to discuss novel research mechanisms or results that have the potential to generate public health solutions to end suicide.

In June 2020, the PREVENTS task force developed and publicly released¹⁰¹ a comprehensive public health roadmap for helping Veterans pursue an improved quality of life and ending the national tragedy of Veteran suicide. The roadmap includes a “National Research Strategy.” The strategy takes a broad public health approach to investigate and understand the dynamic nature and inherent complexity of factors associated with enhanced suicide risk, the onset of suicidal behaviors, and opportunities for intervention long before the individual is at greatest risk for self-harm. The strategy puts forth two goals: (1) promote individualized approaches to suicide prevention and treatment; and (2) enhance the research ecosystem by accelerating the development and implementation of scientific discovery through shared data sets, innovative policy, novel funding

mechanisms, and structural changes, supporting team science and reproducibility.¹⁰²

Leveraging Communications Technology to Improve Veterans’ Health

Besides strides made in telemedicine, the FCC passed rules establishing 9-8-8 as a nationwide number for Veterans and citizens to access suicide helpline services.¹⁰³ In cooperation with the VA and SAMHSA, this national resource for suicide prevention is expected to make it easier to connect with this life saving resource.

Leveraging Big Data to Improve Veterans’ Health

In May 2017, the VA and DOE announced a partnership to advance innovation and transform health care delivery for Veterans.¹⁰⁴ The partnership brings together world leading capabilities and resources of each agency to conduct data-driven research by leveraging VA’s data on about 24 million Veterans who sought care within in the VA over the last two decades—including nearly 600,000 Veterans who volunteered their genomic and lifestyle data—and DOE’s world class HPC capabilities and AI and data analytics expertise.

At the center of the partnership is MVP CHAMPION (Million Veterans Program Computational Health Analytics for Medical Precision to Improve Outcomes Now). Under MVP CHAMPION, VA and DOE have established a secure scientific computing environment that provides researchers with access to MVP data and promotes transformational science and innovation.¹⁰⁵ MVP CHAMPION projects span various topics including cardiovascular disease, prostate cancer, polypharmacy, mental health, and suicide.

ENHANCING AMERICAN SECURITY

“Our government's first duty is to its people, to our citizens—to serve their needs, to ensure their safety, to preserve their rights, and to defend their values.”

Donald J. Trump, President of the United States

With a wide range of threats intensifying in recent years, advances in S&T are increasingly vital to equip our Armed Forces and to protect the American people, the homeland, and the American way of life. Advancements have furthered our understanding of the nature of threats and developed strategies and mitigation measures to counter them. To maintain our competitive advantage, the United States is prioritizing emerging technologies critical to security.

HIGHLIGHTS INCLUDE:

Established a National Strategy for Critical and Emerging Technologies

In September 2020, the Administration released its first integrated “National Strategy for Critical and Emerging Technology” (C&ET).¹⁰⁶ Led by the National Security Council (NSC) staff, and in coordination with OSTP and Federal departments and agencies, the strategy articulates a whole-of-government approach to promoting the National Security Innovation Base while protecting key critical and emerging technologies from competitors and adversaries that seek to gain advantage through illicit technology transfer at the expense of the United States and its allies and partners. Additionally, the National Strategy defines key critical and emerging technology areas, as identified by the interagency, that enable national security and economic advantage now and in the future.

Establishing DoD Modernization Priorities

In January 2018, the DoD released the “2018 National Defense Strategy,”¹⁰⁷ which observed that the security environment is affected by rapid technological advancements and that “[w]e cannot expect success fighting tomorrow’s conflicts with yesterday’s weapons or equipment.” The Strategy committed to “invest in modernization of key capabilities” and in “technologies that ensure we will be able to fight and win the wars of the future.” The has DoD established 11 such modernization priorities—AI; biotechnology; autonomy; cyber; directed energy; fully networked command, control, and communications; microelectronics; quantum science; hypersonics; space; and 5G—and designated for each a principal director to develop and lead a DoD-wide, mission focused roadmap to deliver the technical capabilities needed by America’s warfighters.¹⁰⁸

Developing Hypersonics

The Missile Defense Agency (MDA) completed the evaluation of industry-proposed hypersonic defense weapon system designs and selected those with the highest potential for further concept refinement, continued technical design maturation, and detailed modeling and simulation.¹⁰⁹ MDA revealed a new hypersonic defense program, the Regional Glide Phase Weapon System prototype development program, which focuses on demonstrating the effectiveness of key technologies and capabilities for an interceptor design leading to a flight test experiment in the near future.¹¹⁰ In parallel, MDA awarded eight hypersonic defense component technologies contracts to industry for the maturation of key technologies in support of hypersonic defense.

Advancing Hypersonic Defense

The Trump Administration is investing in R&D to deliver advanced military capabilities necessary for meeting emerging threats and protecting American security in the future, including offensive and defensive hypersonic weapons capabilities.

To accelerate the development and fielding of weapon system prototypes, the DoD has seen a **ten-fold increase** in investment in hypersonics compared to 2016 funding levels. In addition, flight testing has increased dramatically from one test every two years to approximately 10 flights per year.



Caption: Future hypersonic missiles such as this one conceived by one of the MDA’s potential bidders for its Hypersonic Defense Weapon System program, are key for the Nation’s defense capabilities.

Credit: Raytheon



Caption: U.S. CTO Michael Kratsios joins Trump Administration officials for an important conversation in January 2020 with government, industry, and first responders on using AI to improve capabilities.

Credit: OSTP

Enhancing Capabilities for Tracking Advanced Missile Threats

In October 2020, the Space Development Agency announced that two companies won bids to help build out an enhanced tracking layer for the National Defense Space Architecture.¹¹¹ Under these contracts, each company will contribute four overhead persistent infrared tracking (OPIR) satellites to provide tracking data for hypersonic glide vehicles and the next generation of advanced missile threats.

Investing in Biotechnology

Recognizing the importance of biotechnology to U.S. economic and national security, the DoD named biotechnology a modernization priority in 2019 and is prioritizing and investing in this critical area. For example, in 2020, the DoD launched a competition for a Bioindustrial Manufacturing Innovation Institute to support development of bioindustrial manufacturing technology.¹¹² In September 2020, the DOD hosted its first STEM and Biotechnology Virtual Seminar, as part of an increased focus of DoD STEM efforts on biotechnology aimed at helping to enable breakthrough capabilities spanning medicine, chem-bio defense, new materials, and advanced manufacturing.¹¹³

Strengthening the Nation's Cybersecurity

Through the Cybersecurity and Infrastructure Security Agency and the National Risk Management Center (NRMCC), the U.S. Department of Homeland Security (DHS) partnered with critical infrastructure stakeholders to identify and mitigate risks to emerging technologies; forming an Information and Communication Technology (ICT) Supply Chain Task Force¹¹⁴ that brought government and industry together to address supply chain and vendor risks to 5G and other technology innovations.

NSA released its software reverse-engineering framework, Ghidra, as an open source project.¹¹⁵ With over half a million downloads, Ghidra has been hailed as a game changer and has already launched commercial training programs and influenced curricula. The government continues to accrue benefit through Ghidra features and capabilities submitted by the open-source community. Ghidra was recognized with an R&D 100 Award, which honors the best innovations and technologies of the year.



Caption: U.S. CTO and Acting Under Secretary of Defense for Research and Engineering Michael Kratsios discusses the DoD's modernization priorities.

Credit: DoD

Coordinating National Resilience to Electromagnetic Pulses

In March 2019, President Trump signed an Executive Order that established the first ever comprehensive national policy on building resilience to electromagnetic pulse (EMP) events.¹¹⁶ The Executive Order identifies Federal activity critical to EMP security and encourages private sector engagement to foster sustainable, risk-based, and cost-effective approaches that will better protect the Nation's critical technology and infrastructure from EMP effects. As part of the implementation of this Executive Order, the NSTC coordinated development of, and in June 2020, released a report on, "Research and Development Needs for Improving Resilience to Electromagnetic Pulses."¹¹⁷ Additionally in September 2020, the NOAA Space Weather Prediction Center, in collaboration with the U.S. Geological Survey (USGS), announced the release of enhanced, operational, near-real-time geoelectric field maps of the United States that use an improved description of Earth conductivity to provide a more accurate estimate of geoelectric field and currents induced by EMP events.¹¹⁸

Defending the Nation from Nuclear and Radiological Attacks

The Trump Administration is applying S&T to enhance America's capabilities for preventing and defending against nuclear and radiological attacks. In December, the NSTC released the "Nuclear Defense Research and Development Strategic Plan for Fiscal Years 2020-2024."¹¹⁹ This plan identifies R&D priorities to help achieve policy objectives in five mutually-reinforcing elements of America's overall nuclear defense posture. Implementing this plan will strengthen America's overall nuclear defense posture, ensuring that we are taking steps today to prepare the Nation to avert or meet the threats of tomorrow.

EXPLORING, PRESERVING, & PROTECTING OUR OCEANS

“We cherish our magnificent land and waterways, abundant natural resources, and unique wildlife. As a Nation, it is our duty to recognize the importance of these life sustaining gifts, and it is our responsibility to protect them for our own benefit and that of generations to come.”

Donald J. Trump, President of the United States

The Trump Administration recognizes the importance of ocean, coastal, and Great Lakes waters to the economy, national security, and the environment. Together, our oceans and Great Lakes support maritime commerce, domestic seafood production, healthy and sustainable fisheries, coastal resilience, energy production, tourism and recreation, environmental protection, national and homeland security, and other interests. These activities contribute more than \$300 billion per year of economic activity, 2.3 million jobs, and \$162 billion in wages.¹²⁰ Developing new and innovative ways to conserve, manage, and ensure the balanced use of these waters will safeguard American health, prosperity, and security.

HIGHLIGHTS INCLUDE:

Promoting the Ocean Economy, Ocean Security, and Ocean Environment

In June 2018, President Trump signed an Executive Order “Regarding the Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States.”¹²¹ The policy establishes an interagency Ocean Policy Committee (OPC) to streamline Federal coordination, empowers States and territories through Federal engagement with regional ocean partnerships, and focuses on growing the

ocean economy, prioritizing S&T research, coordinating resources and data sharing, and engaging with stakeholders.¹²²

Ensuring United States Leadership in Ocean S&T

In 2018, the Administration also released a 10-year plan identifying pressing research needs and a decadal vision for an innovative and collaborative ocean S&T enterprise that promotes American security and prosperity while conserving the marine environment for present and future generations.¹²³ In addition to five overarching goals, the plan identifies areas of immediate opportunity and action,

Federal Agencies in Action: Defining our Marine Critical Minerals Resources

In response to the 2019 Executive Order on a Federal Strategy to Ensure Reliable Supply of Critical Minerals, U.S. Department of the Interior (DOI) Bureau of Ocean Energy Management (BOEM), the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Geological Survey (USGS) have partnered to develop joint strategies to explore and characterize the critical marine mineral wealth of the U.S. interagency efforts initiated in 2019, including planning for a 2020 research expedition to map and characterize the mineral deposits and sensitive marine habitats along the Escanaba Trough offshore Northern California and Southern Oregon. This area includes hydrothermal sulfide deposits that contain critical minerals of unknown economic potential.

BOEM and USGS are working together to evaluate the marine mineral resources of the Outer Continental Shelf offshore Alaska. USGS will synthesize oceanographic and marine geologic data to create regional permissive region marine mineral maps to help prioritize Federal and private sector exploration for critical minerals, including possible ferromanganese crusts on the Chukchi Plateau, manganese nodules in the Canada Basin (north of the North Slope of Alaska), and seafloor massive sulfides and hydrothermal oxides along the Aleutian Arc.



Caption: OSTP Director Kelvin Droegemeier and former NSF Director France Córdova participate in “The White House Summit on Partnerships in Ocean S&T” November 2019.

Credit: Department of Energy



Caption: BOEM archaeologist and pilot prepare for a submersible dive.
Credit: NOAA

which include integrating big data approaches in Earth system science, advancing monitoring and predictive modeling capabilities, improving data integration in decision-support tools, supporting ocean exploration and characterization, and supporting ongoing partnerships.

Advancing Knowledge of America’s Ocean, Coastal, and Great Lakes Resources

In November 2019, President Trump signed a Presidential Memorandum directing the OPC to coordinate the development of a national strategy for mapping, exploring, and characterizing the U.S. Exclusive Economic Zone (EEZ).¹²⁴ This ocean area, which extends 200 miles from land and is equal in size to the landmass of the continental United States, has never been comprehensively mapped or systematically explored and researched.

The June 2020 “National Strategy for Mapping, Exploring, and Characterizing the United States EEZ,” establishes five goals that will guide comprehensive and systematic mapping of the region, exploring and characterizing priority areas, developing and employing new science and technologies, and building public and private partnerships to support all aspects of the enterprise.¹²⁵

Supporting the Economy and Security of Alaska

The Presidential Memorandum also directs NOAA to coordinate the development of a strategy to map the shoreline and nearshore of Arctic and sub-Arctic Alaska.¹²⁶ The strategy, developed in coordination with the State of Alaska, other Federal agencies, native Alaskans, and other stakeholders, will guide a mapping program that will enhance resource management and the safety and security of coastal residents.

Building Partnerships to Ensure U.S. Leadership in Ocean S&T

In November 2019, OSTP and The White House Council on Environmental Quality hosted The White House Summit on Partnerships in Ocean Science and Technology, which brought together over 100 leaders and experts from philanthropy, the private sector, academia, and the Federal Government to identify opportunities for partnerships to develop and employ S&T that promote American security and prosperity while conserving the marine environment for present and future generations.¹²⁷

PROMOTING SPACE LEADERSHIP

This time, we will not only plant our flag and leave our footprint, we will establish a foundation for an eventual mission to Mars and perhaps, someday, to many worlds beyond.

Donald J. Trump, President of the United States

More than fifty years after Apollo 11 landed on the moon, our Nation stands yet again at another precipice for space exploration. During the first term, the Trump Administration has made the investments and enacted the policies necessary to realize this goal.

HIGHLIGHTS INCLUDE:

Reviving the National Space Council

In June 2017, the President issued an Executive Order on “Reviving the National Space Council,”¹²⁸ to provide a coordinated process for developing and monitoring the implementation of national space policy and strategy. The Council was established in 1989 and never formally disbanded, but it effectively ceased operation in 1993. The revived Council is chaired by the Vice President, and is tasked with advising and assisting the President regarding national space policy and strategy.

Venturing from the Moon to Mars

In December 2017, the President directed NASA to embark on a journey back to the Moon.¹²⁹ The Artemis program aims to send the first American woman and the next American man back to the lunar surface by 2024 and establish a sustained human presence on the surface to prepare for the first human mission to Mars.^{130, 131} S&T progress in Artemis includes the building of spaceflight hardware and breakthroughs in studies and tests of relevant instruments.¹³² Increased cooperation between the Federal Government, the U.S. commercial aerospace industry, and international partnerships, with bipartisan support from Congress, has been critical to achieving this progress. In April 2020, NASA awarded contracts to three different U.S. commercial space companies—Blue Origin, Dynetics, and SpaceX—for the first crewed lunar lander in over 50 years. These teams, each with their own innovative designs, will compete for the award to land the next Americans on the lunar surface in 2024. The remarkable progress in Artemis is paving the way for the U.S. Government and its partners to take the courageous leap from the Moon to Mars.

Continuing to Lead in Space Exploration

In 2019, America continued to lead in space exploration, with five astronauts from NASA's 2013 class participating in their first spacewalk at the International Space Station.¹³³ On October 18, 2019, two of those astronauts, Christina Koch and Jessica Meir, successfully completed the first all-woman spacewalk, an important milestone for the space program.¹³⁴ Koch and her colleague, Andrew Morgan, participated in extended space missions to study human response to spaceflight over long periods of exposure.¹³⁵

“Today a new era in human spaceflight begins as we once again launched American astronauts on American rockets from American soil on their way to the International Space Station, our national lab orbiting Earth...The launch of this commercial space system designed for humans is a phenomenal demonstration of American excellence and is an important step on our path to expand human exploration to the Moon and Mars.”

Jim Bridenstine, Administrator, NASA

The SpaceX Crew Dragon Launch

On May 30, 2020, for the first time in history, NASA astronauts launched from American soil in a commercially-built and operated American crew spacecraft, on its way to the International Space Station. The first crewed launch of NASA's Commercial Crew Program, the SpaceX Crew Dragon spacecraft carrying NASA astronauts Robert Behnken and Douglas Hurley, lifted off at 3:22 p.m. EDT on the company's Falcon 9 rocket at NASA's Kennedy Space Center in Florida. Known as NASA's SpaceX Demo-2, the mission was an end-to-end test flight to validate the SpaceX crew transportation system, including launch, in-orbit, docking, and landing operations. The program demonstrates NASA's commitment to investing in commercial companies through public-private partnerships and builds on the success of American companies, including SpaceX, already delivering cargo to the space station.¹³⁶



Caption: President Donald J. Trump, Vice President Mike Pence watch the SpaceX Demonstration Mission 2 launch on May 30, 2020, at the Kennedy Space Center Operational Support Building in Cape Canaveral, FL.

Credit: Official White House Photo by Shealah Craighead

Reaching New Frontiers in Robotic Exploration of the Solar System

The Perseverance Rover is now on its way to Mars.¹³⁷ It launched on July 30, 2020, on an Atlas V-541 rocket from Cape Canaveral, Florida. The Mars 2020 Perseverance Rover will search for signs of ancient microbial life, which will advance NASA’s quest to explore the past habitability of Mars. The rover incorporates a drill to collect core samples of Martian rock and soil, then stores them in sealed tubes for pickup by a future mission that would ferry them back to Earth for detailed analysis. Perseverance will also test technologies to help pave the way for human exploration of Mars. Strapped to the rover’s belly is a technology demonstration Mars Helicopter, Ingenuity, which may achieve a “Wright Brothers moment” by testing the first powered flight on the Red planet.¹³⁸

NASA’s historic Parker Solar Probe mission is revolutionizing our understanding of the Sun, where changing conditions can propagate into the solar system, affecting Earth and other worlds. Parker Solar Probe travels through

the Sun’s atmosphere, closer to the surface than any spacecraft before it, facing brutal heat and radiation conditions to provide humanity with the closest-ever observations of a star. Since its launch in August 2018, Parker Solar Probe has completed four of 24 planned passes through never-before-explored parts of the Sun’s atmosphere.¹³⁹

In January 2019, scientists from NASA’s New Horizons mission released the first detailed image of the most distant object ever explored in the solar system—the Kuiper Belt object nicknamed Ultima Thule. Its remarkable appearance, unlike anything seen before, illuminates the processes that built the planets four and a half billion years ago. The new images revealed Ultima Thule as a “contact binary,” consisting of two connected spheres. End to end, the world measures 19 miles (31 kilometers) in length. The team says that the two spheres likely joined as early as 99 percent of the way back to the formation of the solar system, colliding no faster than two cars in a fender-bender.



Caption: A United Launch Alliance Atlas V rocket with NASA's Mars 2020 Perseverance rover onboard launches on July 30, 2020, at Cape Canaveral Air Force Station, FL.

Credit: NASA/Joel Kowsky

Safely Developing Space Nuclear Systems

In August 2019, President Trump signed a Presidential Memorandum on Launch of Spacecraft Containing Space Nuclear Systems.¹⁴⁰ This Memorandum will help ensure that America can safely develop space nuclear systems that enhance our ability for space exploration, our operational capabilities, and the potential for increased commercial space activities. This Memorandum established an updated and risk-informed process for launching space nuclear systems that are funded or licensed by the Federal Government. With this Memorandum, the Trump Administration is enabling forward-looking, rigorous, and effective nuclear safety analysis, allowing the Federal Government and the private sector to use space nuclear systems as we return to the Moon and venture beyond.

Strengthening Resilience to Space Weather Events

In March 2019, the NSTC released the updated National Space Weather Strategy and Action Plan.¹⁴¹ The Strategy and Action Plan provides a collaborative roadmap for strengthening America's resilience to space weather events. As an early implementation achievement, in April 2019, NSF and NASA sponsored a workshop to gather input on how to improve understanding of extreme space weather events, resulting in recommendations from an expert panel on opportunities for improving existing benchmarks.¹⁴² These

inputs will inform the establishment of higher-fidelity estimates of the characteristics of 1-in-100-year and theoretical maximum events. Another important step that supports the strategy was completed in May 2019 when DHS released a Federal Operating Concept for Impending Space Weather Events.¹⁴³ This operating concept provides guidance to departments and agencies to be used in the development of their operational plans to prepare for, protect against, and mitigate the effects of impending space weather events. Preparing for space weather events is an important aspect of broader American resilience, which is a priority of this Administration. Greater resilience to space weather will bolster national and homeland security and will strengthen U.S. leadership in space.

Protecting Critical Space Systems from Threats

Amid growing concern of evolving cyber threats to space assets and supporting infrastructure, the Administration is protecting critical space assets, such as those used for positioning, navigation, and timing; intelligence, surveillance, and reconnaissance (ISR); satellite communications; and weather monitoring. Space Policy Directive 5, the Nation's first comprehensive cybersecurity policy for space systems, was signed by the President in September 2020 to foster practices to protect space assets and operations by the U.S. Government and private space companies.¹⁴⁴ This policy establishes principles based on widely accepted cybersecurity approaches for non-space systems and incorporates elements that address the specific challenges of securing the Nation's space systems against cyber threats.

The Administration also issued the Executive Order on "Strengthening National Resilience through Responsible Use of Positioning, Navigation, and Timing (PNT) Services" in February 2020.¹⁴⁵ Recognizing the Nation's reliance on GPS as the foremost PNT source, the Administration seeks to understand how a disruption of the Global Positioning System (GPS) could challenge the reliable and efficient functioning of critical infrastructure. Further, while this policy recognizes how space-based PNT has improved the lives of Americans, it encourages the adoption of multiple and varied sources of these signals to alleviate risk of over-reliance on GPS. As a result of this Executive Order, NIST developed and in October 2020 published a foundational

Federal Agencies in Action: Achieving First Light for Dark Energy Experiment

The DOE-supported Dark Energy Spectroscopic Instrument (DESI) [achieved first light](#) in 2019, becoming the most powerful multi-object spectrograph on the planet. Led by Lawrence Berkeley National Laboratory and supported by DOE's Office of High Energy Physics, DESI will study the spectra of distant galaxies using an array of 5,000 independently swiveling robotic fiber-optic positioners to build a 3D map of the cosmos and uncover the nature of dark energy. DESI is installed on a mountaintop in Arizona and undergoing commissioning to ensure excellent data quality before it begins measuring 35 million galaxies and quasars over five years. A large international collaboration, DESI involves about 500 researchers at 75 institutions in 13 nations. DESI passed a Federal review in March 2020, and members of a Federal advisory board formally approved the completion of the project on May 11, 2020.



Caption: OSTP Director Kelvin Droegemeier joins Vice President Mike Pence, Second Lady Karen Pence, OMB Director Russ Vought, and members of the National Space Council in a video call to American astronauts aboard the International Space Station.

Credit: Official White House Photo

PNT profile to help organizations identify systems, networks, and assets dependent on PNT services; identify appropriate PNT services; detect disruption and manipulation of PNT services; and manage the associated risks to the systems, networks, and assets dependent on PNT services.¹⁴⁶

Streamlining Regulations to Enable Commercial Space Activities

Since taking office, this Administration has continued to remove barriers to unleash American industry in space. President Trump signed Space Policy Directive 2 in May 2018 to require various departments and agencies to streamline regulatory requirements to ensure that there are no undue barriers to acceleration of commercial space activities.¹⁴⁷ The FAA is streamlining launch and reentry regulations to encourage growth of commercial space transportation while protecting the general public. To do so, relevant departments and agencies are transforming the launch and re-entry licensing regime to better reflect the higher cadence of launches and modern space transportation systems enabled by advances in the American commercial space sector.

Additionally, to advance Space Policy Directive 2, in May 2020, the U.S. Department of Commerce (DOC) released new regulations to improve the licensing process for private U.S. satellite remote sensing operations;¹⁴⁸ the DOC and

U.S. Department of State are reviewing the U.S. space export control regime with the goal of improving the competitiveness of the domestic space industry while protecting national security;¹⁴⁹ and the FCC has streamlined its satellite rules and updated its rules and policies governing non-geostationary orbit (NGSO) systems, including adopting spectrum sharing rules for NGSO systems.¹⁵⁰ The FCC has approved 12 applications to launch NGSO satellite constellations that can provide high-speed broadband and other services.¹⁵¹ The FCC is continuing its efforts to streamline the process for siting of domestic satellite ground stations.

Providing a Safe Space Environment

Prevention and mitigation of orbital debris and management of space traffic is in the interest—and is the responsibility—of all spacefaring nations to keep the space environment safe, stable, and operationally sustainable. In June 2018, the President signed Space Policy Directive 3, the Nation’s first space traffic management policy, to change the way space traffic management is conducted in the United States and to address the challenges of a congested space-operating environment.¹⁵² To implement Space Policy Directive 3, the Department of Commerce is developing a commercially-focused interface to ensure safe and sustainable domestic and international space activities. OSTP initiated an effort to identify and report on research and development the Nation requires to fully realize the application of space situational awareness in a commercial setting.

BUILDING THE S&T WORKFORCE OF THE FUTURE

“The talent, grit, and spirit of the American worker have always defined our Nation and enabled us to compete and lead in the global economy.”

Ivanka Trump, Advisor to the President

Science, Technology, Engineering, and Math Education

STEM education has accelerated America’s standing as the world’s S&T leader by fostering an ecosystem of discovery, innovation, entrepreneurship, and ingenuity. The strength of the U.S. workforce is one of the most important competitive advantages our Nation possesses in an increasingly competitive global landscape. A first step in building that workforce is providing a strong foundation in STEM-related skills and competencies for all Americans. The Trump Administration recognized from the outset, the importance of STEM education, equity and diversity, evidence-based practices, and engagement with the entire STEM community. Further, the Administration prioritized a nationwide collaboration with learners, families, educators, community leaders, and employers. These actions are helping to prepare the next generation of trailblazers who will advance S&T progress, economic prosperity, security, and health.

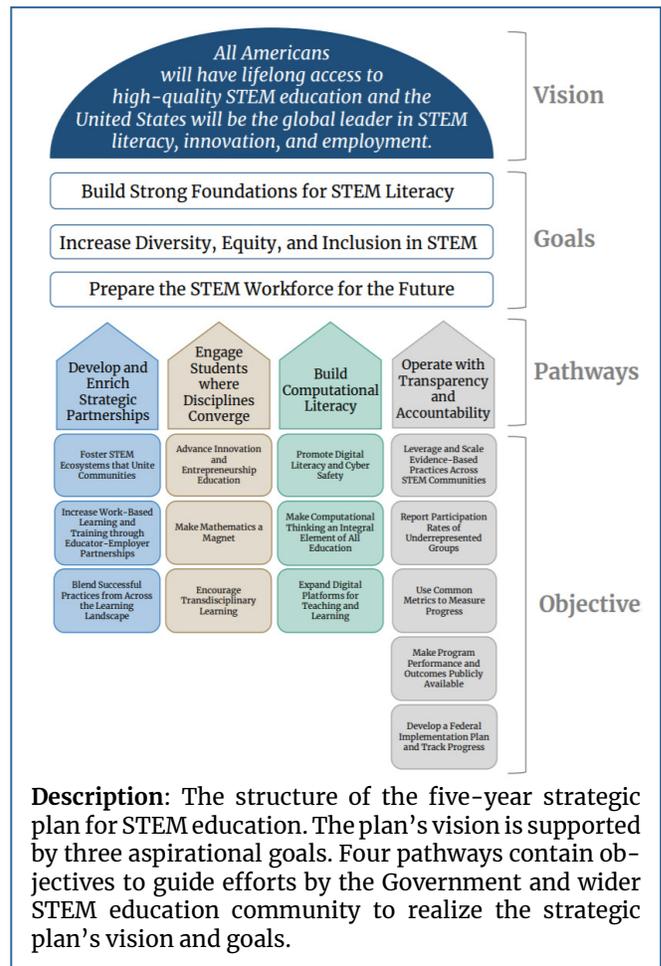
HIGHLIGHTS INCLUDE:

Creating a Strategic Plan for STEM Education

In December of 2018, the NSTC Committee on STEM Education (CoSTEM) released the Federal STEM Education Strategic Plan, “Charting a Course for Success: America’s Strategy for STEM Education,” which outlines the goals for American STEM education.¹⁵³ These goals include (1) building a strong foundation of STEM literacy, (2) increasing diversity and inclusion in STEM education, and (3) preparing the STEM workforce of the future. The Strategic Plan serves as a “North Star” to the broader STEM education community to chart a course for collective success. Since publishing the report, CoSTEM continues to update the American people on the implementation of the plan through its annual progress report.¹⁵⁴

Prioritizing STEM Education Access for All Americans

In late 2017, the President signed a Presidential Memorandum expanding access to high-quality STEM and computer science education to K-12 students, underpinning his commitment to prepare Americans for jobs of the future.¹⁵⁵ This



early action affirmed the Administration’s unwavering focus on the importance of STEM literacy and providing women, minorities and students across the country with multiple pathways to career success.

In December 2019, building on two years of progress following the Presidential Memorandum, President Trump signed two bills into law to enhance inclusion in our Nation’s STEM ecosystem. The first—the “Fostering Undergraduate Talent by Unlocking Resources for Education Act or the FUTURE



Caption: U.S. CTO Michael Kratsios joins Advisor to the President Ivanka Trump at The White House STEM Education Summit.

Credit: Official White House Photo

Act”—provides \$255 million in annual funding for minority serving institutions.¹⁵⁶ The second—the “Building Blocks of STEM Act”—builds on the Administration’s efforts to expand access to high-quality pre-kindergarten and elementary STEM education and encourage women to participate in computer science courses.¹⁵⁷

Building new Partnerships for STEM Education

Through the launch of the National Q-12 Education Partnership,¹⁵⁸ the Administration is ensuring that every American, regardless of age or background, has the skills needed to compete and succeed in tomorrow’s workplace through access to high-quality STEM education and alternative career pathways. Similarly, NSF INCLUDES (Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science), which focuses on making a lasting, positive effect in diversifying the STEM workforce of the future through partnerships and collaboration at scale, has committed \$20 million towards this

initiative in FY 2020 and has expanded partnerships with ED, NASA, NOAA, NIH, NIST, and the U.S. Geological Survey (USGS).¹⁵⁹ To help support Veterans and military spouses pursue careers in STEM, President Trump signed “The Supporting Veterans in STEM Careers Act” in February 2020.¹⁶⁰ This legislation will help Veterans translate skills gained in the military to fill needed gaps in the STEM workforce.

Investing in STEM Education

In its yearly memoranda establishing R&D budgetary priorities for Federal departments and agencies, the Administration has repeatedly highlighted STEM education as a cross-cutting focal area.¹⁶¹ In FY 2020 alone, 17 Federal departments and agencies invested an estimated \$3.7 billion in STEM education. This investment funded 174 STEM education programs serving students, teachers, faculty, and upskilling of STEM workers.¹⁶²



Caption: PECASE Awardees celebrate their achievements in Washington, DC in July 2019.

Credit: OSTP

Recognizing STEM Teachers, Mentors, and Early Career Professionals

On July 25, 2019, 314 early-career professionals were presented with the Presidential Early Career Award for Scientists and Engineers (PECASE). The PECASE is the highest honor bestowed by the U.S. Government to outstanding scientists and engineers who are beginning their independent research careers and who show exceptional promise for leadership in S&T. Since it was created in 1996, PECASE has highlighted the key role that the Federal Government places in encouraging and accelerating American innovation to grow our economy and tackle our greatest challenges.

During the Trump Administration, NSF and OSTP have recognized the remarkable achievements of hundreds of teachers and mentors through the Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST) and the Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM). In June 2018, NSF and OSTP welcomed over 140 teachers to the Nation's Capital to celebrate and pay tribute to teachers and mentors from all across the nation. In the fall of 2019, an additional 300-plus teachers and mentors were honored in conjunction with a Federal STEM education summit that engaged awardees and STEM leaders to discuss the release of The White House "Progress Report on the Federal Implementation of the STEM Education Strategic Plan."¹⁶³ In August 2020, NSF and OSTP virtually recognized another 122 teachers and mentors for their remarkable commitment to helping students succeed in STEM.

The American Worker

As we experience a new wave of S&T progress in the Industries of the Future and other critical fields, everyone from researchers to electricians, to farmers and machinists require lifelong opportunities to grow their knowledge and skills. This Administration has prioritized these in demand fields through the establishment of the National Council for the American Worker, responsible for protecting our Country's greatest asset—the American people—and coordinating policy that invests in our citizenry by providing opportunities for education and training so they may thrive in the modern workplace.

HIGHLIGHTS INCLUDE:

Increasing Opportunities for Life-long Learning

In June 2017, President Trump signed an Executive Order on Expanding Apprenticeships in America. The Administration constructed this effort to prepare more students and workers with the right technical skills through innovative apprenticeship and job training programs while reducing debt burden.¹⁶⁴ Through the Department of Labor (DOL) funding priorities, this Executive Order emphasized support for educational institutions' existing efforts to integrate industry-recognized credentials and programs into their curricula. The Executive Order also paved the way for both apprenticeship.gov and Industry-Recognized Apprenticeship Programs designed to connect job seekers and employers with apprenticeship programs and resources



Caption: President Donald J. Trump, Advisor to the President Ivanka Trump, and Director of the U.S. National Economic Council Larry Kudlow participate in the "Our Pledge to America's Workers" event.

Credit: Official White House Photo by Joyce N. Boghosian

across the country. Building on this, DOL announced the first Industry-Recognized Apprenticeship Program, in October 2020.¹⁶⁵

In July 2018, the Trump Administration signed into law the “Strengthening Career and Technical Education (CTE) for the 21st Century Act.”¹⁶⁶ The Act modernized the Perkins CTE Act to more fully develop the academic, career, and technical skills that are industry-driven while providing dual enrollment opportunities for earning a technical degree cost effectively and efficiently.¹⁶⁷

Since 2017, Federal departments and agencies have introduced programs such as the Department of Education (ED) Federal Work-Study (FWS) Innovative Experimental Sites.¹⁶⁸ The FWS Experiment provides institutions with increased flexibilities, enabling students to earn work-study benefits

while participating in apprenticeships, internships, and work-based learning programs. Students can also earn work-study wages while completing required clinical rotations, externships and student teaching.

The NSF Future of Work at the Human Technology Frontier Program¹⁶⁹ is supporting convergent research to develop new human-technology partnerships that will increase worker productivity and innovation. This research will prepare the workforce for human-technology partnerships by combining the benefits of new technologies, such as AI and virtual environments, with increased understanding of value-based social, economic, and educational impacts. These efforts complement the Pledge to America’s Workers and aim to further expand private sector opportunities, apprenticeships, and internships for students.

The Pledge to America’s Workers

As part of the National Council for the American Worker, the Trump Administration asked companies and trade groups throughout the country to sign the “[Pledge to America’s Workers](#).” Signing the pledge indicated a commitment to expanding programs that educate, train, and reskill American workers from high-school age to near-retirement.

Since President Trump signed the Executive Order establishing the National Council for the American Worker in July 2018, more than 450 companies and organizations have signed the Pledge (as of October 2020), contributing to over 16 million new education and training opportunities for American students and workers over the next five years.



Caption: President Donald J. Trump signs a Presidential Memorandum “Expanding Access to High Quality STEM and Computer Science Education” on September 25, 2017.

Credit: Official White House Photo by Shealah Craighead

Preparing Americans for the Industries of the Future

Ensuring that American workers are prepared for the lotF is a top priority for President Trump. As part of its focus on securing U.S. leadership in these critical industries, the Administration released a national broadband strategy to increase high-speed internet access across America, especially in rural areas. This will allow more Americans to pursue online education and to benefit from the digital economy, lifting up those far outside of tech hubs and well-connected urban centers. See the above section, [“Accelerating American Leadership in the Industries of the Future,”](#) for additional Administration actions aimed at creating an lotF-ready workforce.

Launching the Workforce Grand Challenge

Computational skills and competencies are essential in our increasingly digital world. These changes are in response to the growing recognition that computing skills and competencies are increasingly fundamental to a wide array of disciplines, careers, and student interests. To answer that need, the Workforce Grand Challenge was launched in November of 2019 as a Government-wide prize competition initiative to address the challenges of a 21st Century workforce. Agencies developed, designed, and launched individual prize competitions ranging in size, scope and timeline, but each aimed at finding innovative solutions to reskilling workers, improving the pipeline for the future

workforce, and using lotF to reskill and train across multiple sectors. The Veteran’s Employment Challenge, launched jointly by DOL, DoD, and VA, aimed at developing a new tool to help transitioning service members of the military in their job searches.¹⁷⁰ Many other challenges were incorporated in the broader effort as the Trump Administration continues to support the use of challenges and prize competitions by which departments and agencies can engage and motivate the collective ingenuity of American researchers to solve the most pressing issues facing our Nation.

Fostering Innovation with Prizes and Challenges

The Trump Administration has underscored the power of prizes and challenges to spur private sector engagement, advance scientific research and discovery, and to inspire the next generation of makers and innovators. In March 2018, OSTP led “The White House Roundtable Discussion on Fostering Innovation with Prizes and Challenges,”¹⁷¹ bringing together industry and government leaders to discuss the role of prizes and challenges to foster innovation, solve problems, spur job growth, and save taxpayer dollars. Following that convening and in response to the requirements of the America COMPETES Reauthorization Act of 2010 and the Crowdsourcing and Citizen Science Act, in June 2019, OSTP released a report on the Implementation of Federal Prize and Citizen Science Authority: Fiscal Years 2017-18.¹⁷²

Promoting Remote Learning

Since day one, access to high-quality remote learning has been a priority for the Trump Administration. With the onset of the COVID-19 pandemic, work in this area has accelerated by leaps and bounds. For example, President Trump signed the CARES Act into law in March 2020 with overwhelming bipartisan support.¹⁷³ The FCC and ED are working to promote the use of \$16 billion in funding from the Act’s Education Stabilization Fund for remote learning.¹⁷⁴ Through the effort, the agencies will work with governors, States, territories, and local school districts as they leverage funding to best help students learning from home during COVID-19. Schools can use these funds for tools and resources for distance education including hardware, software, and connectivity.

“Across the country, students, teachers and families are proving that learning can and does happen anywhere...By extending additional funding flexibility to schools, we are helping to ensure student learning continues and supporting teachers as they transition to virtual classrooms...”

Betsy DeVos, Secretary, U.S. Department of Education

In addition, OSTP led joint efforts with American technology companies to make online learning resources more accessible for teachers, parents, and students who are participating in remote learning or work.¹⁷⁵ Many agencies contributed STEM education resources to help populate a jointly developed site, TechforLearners.org, a searchable online database of education technology tools to help facilitate online teaching and learning. The platform includes NASA STEM @ Home,¹⁷⁶ which encourages students and family members to explore questions about the universe and discover answers together through hands-on educational activities from home.

Advancing Learning and Employment Records

In September 2019, the American Workforce Policy Advisory Board (AWPAB) Digital Infrastructure Working Group published a white paper on Learning and Employment Records (LERs), a system that contains verified, transferable information about a person’s educational and training achievements in the classroom or workplace. LERs give individuals ownership of a verified and detailed record of their skills and achievements, and transparently surfaces those skills to current and prospective employers and educational institutions. The White House, through the AWPAB, has facilitated progress on making LERs a reality by enabling collaboration among employers, academic institutions, technology firms, and government partners. The COVID-19



Caption: OSTP Director Kelvin Droegemeier with students at Energy Institute High School in Houston, TX.

Credit: Copyright 2019 Michael Stravato

pandemic has underscored the need for this transformational technology as it has created a massive need for upskilling and reskilling and an unprecedented number of individuals who are looking for work. To this end, members of the AWPAB and their partners developed a series of pilot projects that proved the technical viability of LERs, employed best practices to build scalable, interoperable systems, and deployed the technology against the critical challenges facing employers and the American worker.

Supporting Telehealth and Remote Learning by Waiving Gift Rules

The FCC waived gift rules in the Rural Health Care and E-Rate programs to make it easier for broadband providers to support telehealth and remote learning efforts during the pandemic.¹⁷⁷ The waiver will allow healthcare providers, schools, and libraries to accept improved capacity, Wi-Fi hotspots, networking gear, or other equipment or services to support doctors and patients, teachers and students, and librarians and patrons during the coronavirus outbreak.

PROMOTING & PROTECTING THE RESEARCH ENVIRONMENT

“The values we cherish as Americans are the ethos of research itself; namely, the freedom to explore new frontiers, the commitment to openness and transparency through the sharing of methods and results, the ability to debate difficult issues thoughtfully and with civility, and the passion to work with and improve the lives of others. The success of our research enterprise is dependent on everyone upholding the principles of research.”

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

Continued American global leadership in S&T requires that the environments in which research takes place are safe, inclusive, operate with maximum integrity, appropriately balance openness and international collaboration with security, and do not encumber researchers, agencies, or institutions with unnecessary administrative work. By prioritizing a research environment built on strong values,¹⁷⁸ the Trump Administration is ensuring maximal return on taxpayer investment in R&D.

The Joint Committee on the Research Environment

In May 2019, NSTC established the Joint Committee on the Research Environment (JCORE),¹⁷⁹ and four interagency subcommittees, to address critical issues facing the U.S. research community, namely:

- ❖ **Strengthening the security of the U.S. research enterprise.**
- ❖ **Reducing administrative burdens on federally-funded research.**
- ❖ **Fostering rigor and integrity in research.**
- ❖ **Creating safe, diverse, inclusive, and equitable research environments for all members of the research enterprise.**

Understanding that the Government alone cannot address these issues, the group engages not only with Federal agencies, but broader stakeholders as well, including research institutions, publishers, individual researchers, industry, non-profit and philanthropic organizations, professional associations and societies, and Congress. By addressing challenges and opportunities within these four interrelated and mutually reinforcing areas, JCORE serves as a whole-of-Nation effort that will help American researchers, scientists, and engineers reach their full potential and unleash discovery and innovation across the scientific enterprise.

Research Security

The open and collaborative nature of the U.S. S&T research enterprise underpins America's innovation, S&T leadership, economic competitiveness, and national security. Maintaining an open environment is critical to fostering research discoveries and innovation that benefit our Nation and the world. At the same time, the openness of this environment must be balanced by approaches to protect nascent intellectual capital, discourage research misappropriation, and ensure responsible management of U.S. taxpayer dollars. Over the past several years, some nations have exhibited increasingly sophisticated efforts to exploit, interfere in, and undermine our research activities and environments. The JCORE Subcommittee on Research Security and the entire Trump Administration have taken tangible measures to protect our research enterprise while striking the appropriate balance between openness and security.



Caption: OSTP Director Kelvin Droegemeier meeting with staff and leadership from Texas A&M University and the University of Texas at Austin to talk about JCORE.

Credit: OSTP

Ensuring Safe and Inclusive Research Environments

The Subcommittee on Safe and Inclusive Research Environments under JCORE addresses the issues essential to recruiting and retaining a diverse science and engineering workforce, promoting creativity, increasing scientific productivity, and preserving U.S. global S&T competitiveness. The subcommittee focuses on ensuring that all researchers are welcomed, valued, encouraged to participate fully, and treated fairly and with respect, without fear of harassment, intimidation, or discrimination. In addition to the Federal coordination facilitated by the Subcommittee, the Federal departments and agencies have initiated policy and programmatic changes to achieve a safe, inclusive, and equitable research environment.

Fostering Rigorous Research

The Administration recognizes that research has its widest effect and is most trustworthy when its methodology and analysis are well-designed, results transparently articulated and openly available for replication, and when findings—including negative results—are published. The JCORE Subcommittee on Rigor and Integrity in Research was established to identify cross-agency principles, priorities, and actions to enhance research integrity, rigor, reproducibility, and replicability. The Subcommittee works collaboratively to support activities that facilitate research rigor and integrity through efforts to address transparency, incentives, communication, training and other areas.

Reducing Administrative Burdens

The Trump Administration recognizes that the U.S. research enterprise must eliminate unnecessary administrative burdens on researchers, research institutions, and agencies to accelerate innovation. The NSTC established the JCORE Subcommittee on Coordinating Administrative Requirements in Research to decrease the estimated 44.3 percent, reported by the Federal Demonstration Partnership (FDP),¹⁸⁰ as the time spent on administrative tasks related to Federal awards rather than actively conducting research. This Subcommittee draws the interagency together to identify policy and technological solutions to accelerate the pace of scientific innovation by reducing or eliminating unnecessary administrative requirements when receiving federal funds for research.

HIGHLIGHTS INCLUDE:

Engaging the Community

To ensure the perspectives of America’s research community are represented, The White House embarked on a listening tour across all U.S. regions over the past year to engage stakeholders on the core focus areas of JCORE. OSTP addressed a letter to the research community¹⁸¹ on JCORE research security and also released an RFI¹⁸² in November

2019, seeking community feedback across all four JCORE areas. This engagement led to a second round of virtual meetings to communicate findings and share information collected by the Subcommittee on Research Security over the past year.

Engaging Stakeholders on the Risk to the Integrity of America’s Research Enterprise

Since launching the Joint Committee on the Research Environment in 2019, OSTP has engaged in extensive interagency coordination and stakeholder outreach on improving the rigor, productivity, inclusiveness, and security of America’s research environments. To date, JCORE has conducted or facilitated listening sessions through 13 regional meetings representing over 47 universities, with another 72 association meetings, and an additional 127 security-related engagements.

In response to a call from the research community for a balanced approach to communicating risks to research, the JCORE Subcommittee on Research Security developed a resource to raise awareness of these risks, “[Strengthening the Security and Integrity of America’s Research Enterprise](#).” OSTP Director Kelvin Droegemeier led eight regional webinars across the country, reaching over 120 universities, to discuss the importance of research security and provide updates on Administration actions to address risks to security and integrity while maintaining an open and collaborative enterprise.

Leading a White House Summit

In November 2019, The White House hosted a summit to discuss JCORE focus areas.¹⁸³ The summit focused on the integrative approach JCORE is taking to develop policy recommendations and best practices aimed at improving the research environment across the four JCORE priority areas. The summit brought together more than 150 leaders from industry, academia, and the Federal Government to inform JCORE activities.

Ensuring a Fair, Inclusive, Secure, Safe Environment for International Research Collaboration

In 2019, OSTP led research integrity discussions with global S&T leaders from 14 countries to ensure that international S&T collaboration—vital to developing solutions for the safety, health, and economic prosperity of our nations—is underpinned by the values of freedom of inquiry, merit-based competition, openness and transparency, accountability, and reciprocity.



Caption: Leaders from across the S&T enterprise attend a White House summit to discuss the four JCORE focus areas in November 2019.
Credit: OSTP

Protecting America from Theft of Technology and Intellectual Property

On May 29, 2020, President Trump issued a proclamation to block certain graduate level and above Chinese nationals associated with entities in China that implement or support China's Military-Civil Fusion strategy, from using F or J visas to enter the United States.¹⁸⁴

“In President Trump, our innovators have a champion in the White House who is fiercely standing up for American values and defending our research system from foreign subversion. JCORE is at the center of this president's whole-of-Nation effort to protect American interests and defend our hard-earned research.”

Kelvin K. Droegemeier, Director, The White House Office of Science and Technology Policy

Enabling Fundamental Research Security

As part of its ongoing efforts to keep international research collaboration both open and secure, NSF commissioned a report by the independent science advisory group, JASON, to enhance the agency's understanding of the threats to

basic research posed by foreign governments that have violated the principles of scientific ethics and research integrity. The report, released in December 2019, affirms the scope and scale of the threat and concludes that problems associated with foreign government interference in the research enterprise can be addressed within the framework of research integrity.”¹⁸⁵

Preventing Unauthorized Transfer of Scientific and Technical Information in DOE's National Labs

In June 2019, DOE implemented a policy restricting DOE employees, including contractors, from participating in foreign government talent recruitment programs sponsored by countries of risk (China, Russia, Iran, and North Korea). Participation in such recruitment programs creates conflicts of interest and the potential for misappropriation of intellectual property.

Protecting the Integrity of U.S. Biomedical Research

NIH has accelerated its efforts to address undue foreign interference in the biomedical enterprise. In August 2018, the NIH Director issued a statement about incidents that violate core principles and threaten the integrity and academic competitiveness of U.S. biomedical research. NIH convened a working group of the Advisory Committee to the Director

on Foreign Influences on Research Integrity. As of September 2020, NIH sent notices to 92 academic and research institutions and identified concerns regarding more than 203 scientists.

Initiating Grant Terms and Conditions

In February 2019, NSF updated its Proposal and Award Policies and Procedures Guide to include a requirement that conference proposers implement a policy or code of conduct that addresses sexual harassment, other forms of harassment, or sexual assault, with clear and accessible means of reporting violations.¹⁸⁶ Additionally, NSF released new conference and awardee organization notification requirements.¹⁸⁷ Similarly, NASA posted the final notice to the Federal Register for a new term and condition regarding sexual harassment, other forms of harassment, and sexual assault.¹⁸⁸



Caption: OSTP Director Kelvin Droegemeier discusses JCORE topic areas with the MIT Graduate Student Council.

Credit: OSTP

Promoting Enhanced Reporting

NIH and NSF created enhanced reporting options that empower researchers by going beyond the formal Title IX complaints requirements by providing an option for individuals to informally notify the agency of a concern. NIH and NSF both allow individuals to notify the agencies directly¹⁸⁹ when filing a complaint of harassment or discrimination.¹⁹⁰

Initiating Anti-Harassment Campaigns

In February 2018, NASA initiated an agency-wide Anti-Harassment Campaign. The campaign comprises a number of components designed to “help support the safety and success of NASA’s workforce and mission by maintaining a harassment-free workplace that provides Equal Employment Opportunity and Diversity and Inclusion, where employees are fully empowered to be heard and to contribute to the agency.” The campaign’s two objectives are to proactively prevent harassment and to promptly correct harassment when it occurs.¹⁹¹

Strengthening the Rigor of Animal Research

In June 2020, the NIH Advisory Committee to the Director (ACD) Working Group on Enhancing Reproducibility and Rigor in Animal Research provided its Interim Report, including the group’s charge, progress, and next steps. Focal areas included methods, results and inferential reproducibility; selection of models; use of pre-registration; effect on NIH resources; and culture change.

Advancing Rigor Practices

On February 28, 2020, OSTP, the NSTC Rigor and Integrity in Research Subcommittee, and the National Academies of Sciences, Engineering, and Medicine (NAEM) Roundtable on Aligning Incentives for Open Science held a joint meeting on aligning incentives in support of research integrity, reproducibility, and openness. The meeting convened Federal departments and agencies, academia, philanthropic organizations, publishing groups, and other stakeholders for a dialogue on best practices and actions to enhance rigorous science and establish jointly affirmed principles.

Reducing Burdens through Policy Guidance

In August 2020, OMB issued revised grants guidance that included measures to reduce administrative work for grantees. These include extending the reporting period for final financial, performance, and other reports from 90 to 120 days; clarifying prime awardees’ responsibilities on audit findings of subawards; increasing the cap for flexible spending for small (“micro”) purchases from \$3,500 to \$10,000, allowing non-Federal entities to self-certify a threshold up to \$50,000; and expanding opportunities for use of simple, non-detailed budgets.

Enabling OMB Grant Flexibilities in Response to COVID-19

To address disruptions and promote resilience within the academic R&D enterprise, at the onset of the COVID-19 pandemic, OMB issued guidance memos to provide flexibilities to recipients of Federal research awards. Core flexibilities included allowing agencies to repurpose their awards to support the COVID-19 response, authorizing continued charging of salaries and benefits; pausing and restarting of grant funded activities on active awards; and delayed submission of financial, performance and other reports.

Reducing Administrative Work through IT Solutions

To reduce unwarranted administrative burden, beginning in October 2020, NSF required use of an NSF-approved format in submission of the biographical sketch and financial support documents. This effort builds on an NSF partnership with NIH to use the NIH developed Science Experts Network Curriculum Vitae (SciENcv) platform as one of two approved NSF formats.

S&T DISCOVERY AND INNOVATION

“Throughout our American story, the trailblazers who have been willing to take great risks and chart new frontiers have changed the landscape of business, science, and technology, often setting the global pace for productivity and prosperity. Their relentless pursuit of success has launched new industries, created millions of jobs, and fueled an economy that is the envy of the world.”

Donald J. Trump, President of the United States

Since the end of World War II, America has built the best discovery and innovation engine. We have done so by enabling and empowering the private sector, academia, governments, and nonprofits to work in mutually complementary ways to discover, innovate, educate, and train, while remaining committed to bedrock American values, such as free inquiry, market-based competition, and inclusion. During the first term, President Trump and the entire Administration have taken decisive action to ensure America remains on the forefront of S&T discovery and that these discoveries yield concrete benefits for Americans across every city and town in the United States and its territories.

S&T Breakthroughs

R&D leads to the discovery of new knowledge, which in turn serves as the building blocks for the innovations that fuel economic prosperity, improve our quality of life, and enhance 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 fundamental research. The investments, policies, and other actions described in this document are already fostering S&T discoveries across numerous fields that will serve as the building blocks of innovation for the decades ahead.

HIGHLIGHTS INCLUDE:

Capturing the First Ever Image of a Black Hole

The Event Horizon Telescope, a planet-scale array of eight ground-based radio telescopes around the world, captured the first image of a supermassive black hole and its shadow. The shadow of a black hole is the closest scientists can come to an image of the black hole itself, a completely dark object from which light cannot escape.¹⁹² This black hole resides 55 million light-years from Earth and has a mass 6.5-billion times that of the Sun.¹⁹³ This breakthrough was the result of sustained funding from NSF, Smithsonian Institute

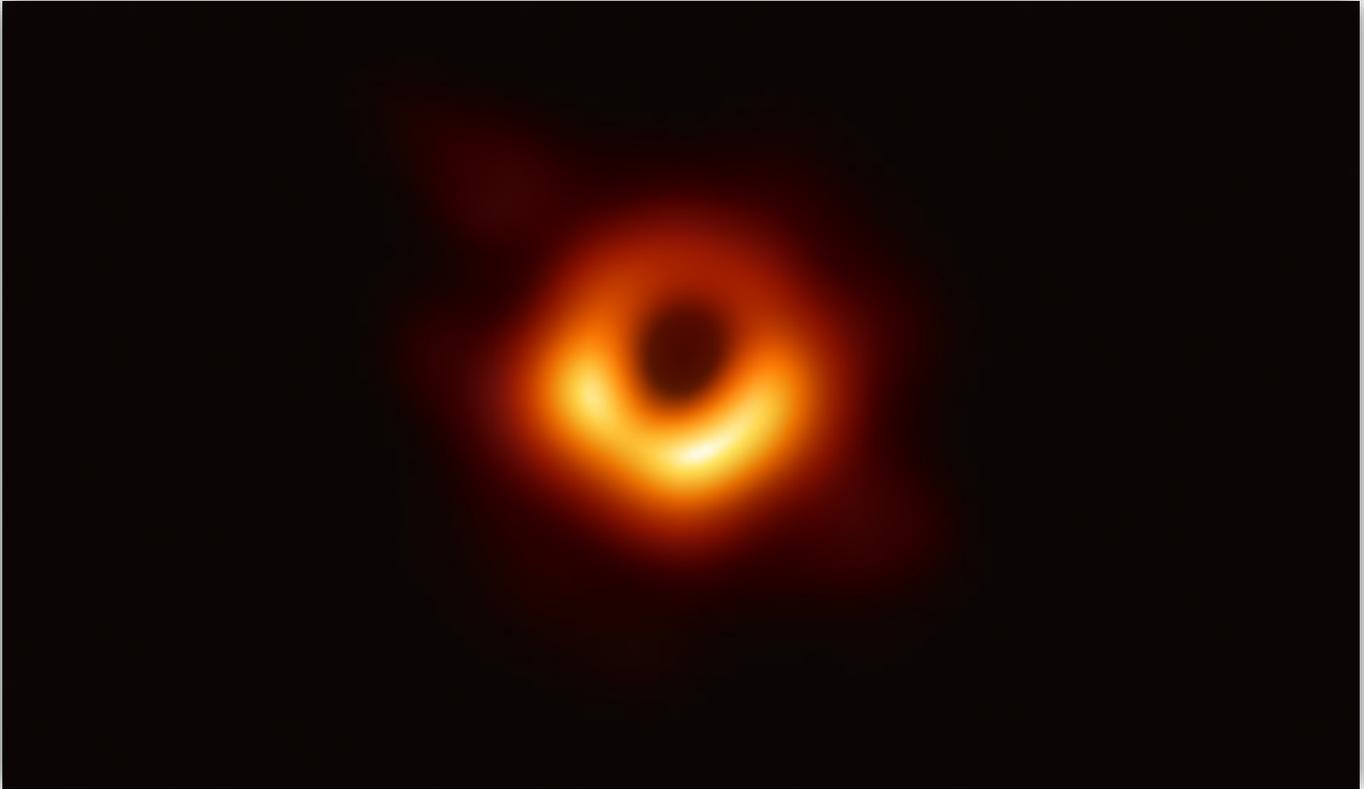
(SI), NASA, DOE and its global partners with over 200 researchers at 60 institutions operating in 20 countries.¹⁹⁴ This historic image expands our fundamental knowledge of the universe, confirms nearly a century of scientific theory, and opens new windows of study into space time.¹⁹⁵

Celebrating Nobel Prize Winners

In 2019, 6 NSF grant recipients were awarded the Nobel Prize, bringing the total number of grantees earning that distinction to 242. The 2019 Nobel Prize in Chemistry was [awarded](#) to John B. Goodenough, M. Stanley Whittingham, and Akira Yoshino “for the development of lithium-ion batteries.” Goodenough is also a Principal Investigator for the DOE grant, “Materials and Interfacial Chemistry for Next-Generation Electrical Energy Storage,” first awarded in 2010 and most recently renewed in 2019. Whittingham is currently the director of the NorthEast Center for Chemical Energy Storage, a DOE Energy Frontier Research Center. Goodenough and Whittingham have played integral roles over the years in Federal advisory committee-related activities, helping DOE to chart an effective path forward in transformative research on energy storage.

Recycling Water in Space

USDA scientists discovered and patented a novel anammox bacteria strain for cost-effective wastewater treatment to remove harmful levels of nitrogen before they reach water bodies like the Chesapeake Bay and Gulf of Mexico.¹⁹⁶ The anammox treatment process would cost only one-third of existing technologies, which in the Chesapeake Bay watershed alone are estimated at \$8.2 billion. In an important venture, USDA partnered with a private firm to license the patented bacteria. On Earth, USDA is using anammox in swine farm lagoons for odor capping, and is partnering with NASA to develop anammox-based treatment reactors for recycling and recovery of water during space exploration and moon or Mars colonization. It costs \$83,000 to transport one gallon of water into space, and four astronauts on the ISS require 12 gallons of water each day, the new treatment reactor would save millions when deployed.



Caption: Using the Event Horizon Telescope, scientists obtained an image of the black hole at the center of galaxy M87, outlined by emission from hot gas swirling around it under the influence of strong gravity near its event horizon.

Credit: Event Horizon Telescope collaboration et al.

Battling Cystic Fibrosis

Through three decades of challenging and innovative work supported by NIH, a non-profit advocacy foundation, and industry, a triple combination therapy for cystic fibrosis (CF) was tested in phase 3 trials and approved in record time by FDA in 2019. This drug combination is capable of revolutionizing the prognosis of 90 percent of patients suffering from this life-threatening condition.¹⁹⁷ By targeting the most common CF-causing mutation that produces protein misfolding and activation, researchers developed a gene function-based treatment that demonstrated safety and efficacy for people with either one or two copies of the mutation.

Advancing the State of Battery Science

DOE-supported researchers made key advances in battery science and technology in 2018. For the first time, researchers at a DOE Energy Frontier Research Center reversibly inserted and extracted two lithium ions from a multi-electron lithium ion battery cathode, with full recovery on recharging—a capability that could greatly increase battery capacity.¹⁹⁸ Scientists used the Advanced Light Source and the Stanford Synchrotron Radiation Light Source to improve understanding of lithium transport—a potential path to safer, longer-lasting, and higher-power batteries.¹⁹⁹

Reducing Ebola Fatalities

In addition to FDA approval of the first vaccine for the Ebola virus,²⁰⁰ DARPA’s Autonomous Diagnostics to Enable Prevention and Therapeutics and Prophylactic Options to Environmental and Contagious Threats programs are supporting fundamental R&D resulting in several types of discovery and gene-encoded monoclonal antibody platforms, and have greatly de-risked the gene-based medical countermeasures field. In 2019, DARPA worked with the NIH Vaccine Research Center on the development and manufacture of mAb-114. The mAb-114 antibody is now being administered at large scale in the Democratic Republic of the Congo and is considered one of the standard treatments for Ebola, reducing fatality rates by more than 70 percent.²⁰¹

Advancing S&T Innovation

The United States spends more than any other nation on R&D each year, investing over \$120 billion in federally-funded R&D alone in 2017, including over 42 percent of all basic research performed in the United States.²⁰² Under the President's leadership the Federal Government has prioritized the rapid translation of S&T discoveries into critical technologies such as life-saving cancer drugs, vaccines, medical devices, and countless other innovations that underpin every aspect of the American way of life.

HIGHLIGHTS INCLUDE:

Unleashing American Innovation

In April 2018, OSTP and NIST held a symposium with leaders across government, industry, and academia to address systemic barriers to reaching the full potential of American innovation. The event launched the Lab-to-Market Cross Agency Priority (CAP) goal, part of the President's Management Agenda (PMA).⁹³ Over the last two years, the NSTC Lab-to-Market subcommittee has convened agencies across the Executive branch to enhance and accelerate the Nation's technology transfer efforts. In 2019, NIST released a Green paper, "Return on Investment Initiative for Unleashing American Innovation,"²⁰³ to advance the Lab-to-Market CAP Goal.²⁰⁴ The Green paper's findings help inform future deliberations, decision-making and potential actions that could maximize the return on taxpayer investment in federally funded R&D. This should, in turn, strengthen U.S. economic competitiveness and support national security needs.²⁰⁵



Caption: DOC Secretary Wilbur Ross (left) and U.S. CTO Michael Kratsios (center) visit the USPTO booth at the 2020 Consumer Electronics Show to learn about Federal Small Business Innovation Research (SBIR)-funded startups.

Credit: OSTP

Issuing Patent Number 10 Million: Advancing Economic Prosperity and Supporting Job Creation

In June 2018, the United States Patent and Trademark Office (USPTO) issued U.S. patent number 10 million, marking a milestone in human ingenuity since the first patent was signed by George Washington in 1790. USPTO has significantly reduced patent application pendency in recent years and made a significant breakthrough in 2019.²⁰⁶ In FY 2019, the USPTO reduced average patent application pendency to under 15 months for first office actions—the lowest level since 2002. Additionally, USPTO has brought the average total pendency for patent applications—the timeframe from filing to final disposition—to under 24 months. The USPTO achieved these milestones despite receiving an ever-increasing number of patent applications—more than 665,000 in FY 2019 alone. Efficient processing of patent applications advances economic prosperity, supports job creation, and supports a business environment that protects, cultivates, and promotes innovation and entrepreneurship. It also advances S&T innovation through increased investment in research, development, and marketing of innovations.

Promoting Innovation and Investment in S&T

A series of court decisions in the past decade has created uncertainty about the types of inventions that were eligible for patenting. In 2019, USPTO announced revised guidance to assist examiners and the public in determining what claimed inventions are eligible for patenting.²⁰⁷ By clarifying the understanding of what it means for an invention to be patent eligible, the USPTO's guidance brought much-needed certainty and predictability to this area of law.²⁰⁸ The revised guidance also reduces administrative barriers related to patent eligibility, making it easier for inventors to obtain patents in technologies that power industries of the future and more.

Supporting Innovative Tools and Services for Technology Transfer in our National Labs

As part of the President's Management Agenda, the Administration has sought to improve engagement with private sector technology development experts and investors to enable even greater return on Federal R&D investments. In July 2018, DOE launched the Lab Partnering Service, an online, single streamlined point of access for industry to connect to experts at the National Laboratories.²⁰⁹ In September, the Federal Laboratory Consortium for Technology Transfer (FLC) launched FLC Business 3.0, incorporating user feed-back to improve this clearinghouse of Federal Laboratory information, including a technology locator chat service that provides personalized advice.²¹⁰

Accelerating Commercialization in High-Impact, Transformative Technologies

To further accelerate its technology transfer activities and engagement with industry, DOE began InnovationXLab summits in September 2018.²¹¹ The XLab series is designed to increase engagement of the National Labs with the private sector on high-impact, potentially transformative technologies. In November 2018, DOE announced the appointment of its first Chief Commercialization Officer.²¹² In 2019, DOE implemented expanded use of Agreements for Commercializing Technology (ACT) that facilitate the ability of lab contractors to engage with industry more flexibly on technology transfer projects.



Caption: Federal leaders from NIST, DOE, and NSF speak at an OSTP co-hosted summit on “Broadening University and Industry Engagement” at Stanford University in December 2019.

Credit: OSTP

Promoting Multisector Partnerships

Partnerships among Federal departments and agencies, between the Federal Government and industry, and multi-sector partnerships facilitated by the USG, serve as force multipliers, enabling partnering organizations to achieve higher returns on investment and create efficiencies through events and other collaboration opportunities. During the past three-plus years, OSTP has brought together every sector to leverage resources and further the objective of PMA CAP Goal 14 to “Improve Transfer of Federally-Funded Technologies from Lab-to-Market.”²¹³

In addition to the many partnership examples offered in this report, OSTP has convened stakeholders from across the S&T enterprise to discuss ways to strengthen S&T partnerships. For example, in the fall of 2019, OSTP hosted 50-plus Federal representatives to share best practices, data, user facilities, and other resources. In December 2019, OSTP and UIDP co-hosted the “Broadening University and Industry Engagement” symposium at Stanford University.²¹⁴ The symposium brought together more than 90 leaders and experts from the private sector, academia, and Federal, State, and

local governments to identify opportunities to broaden and strengthen cross-sector engagement and identify engagement pathways to build new relationships across the S&T enterprise. Lastly, The White House highlighted strengthening multisector partnerships as a cross-cutting action in its FY 2021 and FY 2022 R&D Budget Priorities Memoranda.²¹⁵

Other S&T Highlights

Creation of the Interagency Council for Advancing Meteorological Services

In August 2020, OSTP and NOAA announced the creation of the Interagency Council for Advancing Meteorological Services (ICAMS).²¹⁶ ICAMS was created to improve the mechanism by which Federal departments and agencies coordinate policy and practices to ensure continued U.S. 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.²¹⁷ ICAMS represents the most significant restructuring of the meteorological enterprise since the creation of the Federal Committee for Meteorological Services and Supporting Research in 1964. ICAMS harmonizes crucial activities to improve coordination and creates a streamlined framework that will allow for more effective collaboration with external groups.



Caption: OSTP Director Kelvin Droegemeier and NOAA Acting Administrator Neil Jacobs sign the inaugural charter for the Interagency Council for Advancing Meteorological Services.

Credit: OSTP

Redefining the International System of Weights and Measures

For more than a century, the kilogram (kg)—the fundamental unit of mass in the International System of Units—was defined as exactly equal to the mass of a small polished cylinder, cast in 1879 of platinum and iridium.²¹⁸ In November 2018, NIST worked with partner metrology institutes to move the system of units used world-wide to be entirely

The President's Council of Advisors on Science and Technology (PCAST) Issues its First Report: "Recommendations for Strengthening American Leadership in Industries of the Future"

In June 2020, PCAST issued its [inaugural report](#). In it, PCAST recommended bold actions to help ensure continued American leadership in Industries of the Future. The three pillars underpinning these actions are:

1. **Enhancing multi-sector engagement in research and innovation.** Federal agencies need to take full advantage of their administrative authorities to partner with industry and academia in new and innovative ways, particularly to ensure the effective transition and translation of early-stage research outcomes into applications at scale. In the area of AI, this includes establishing a joint AI Fellow-in-Residence program, AI Research Institutes in all 50 States, National AI Testbeds, R&D, and several other actions.
2. **Creating a new institute structure that integrates one or more of the IotF areas and spans discovery research to product development.** Under the second pillar, PCAST recommends establishing a new type of world-class, multi-sector R&D institute. The goal of these "IotF Institutes" is to catalyze innovation at all stages of R&D—from discovery research to development, deployment, and commercialization of new technologies.
3. **Creating new modalities for ensuring the availability of a qualified, diverse IotF workforce.** Achieving success with the first two pillars of this report rests on the Nation's ability to strengthen, grow, and diversify its STEM workforce at all levels—from skilled technical workers to researchers with advanced degrees.

The principles and recommendations in the PCAST report are interconnected and mutually reinforcing, designed to bridge these pillars and harness key opportunities for the Nation. PCAST believes that the cross-sector actions they recommend will lay a strong foundation for sustaining U.S. discovery, innovation, and prosperity well into the future.

based on fundamental constants of nature and quantum-enabled realizations. This new approach enables improvements in precision measurements that affect everything from pharmaceuticals manufacturing to experimental physics, and will create a new opportunity for the development of new quantum measurement technologies.

Launching an Earthquake Early Warning System

In 2019, USGS and the State of California launched the first-ever State-wide public testing of the California Early Earthquake Warning System, which is powered by USGS's earthquake early warning alerts ("ShakeAlerts").²¹⁹ Alerts were delivered to mobile phones through FEMA's Integrated Public Alert and Warning System's Wireless Emergency Alert capability as well as via a phone app, MyShake, developed by the University of California, Berkeley. This public testing phase was enabled by upgraded seismic networks and data analysis systems and working with State emergency managers, universities, and pilot partners who now have systems actively using USGS-generated ShakeAlerts to develop life-saving products. In 2020, USGS and its partners are continuing to expand these applications in coordination with State agencies in Washington, Oregon, and California.²²⁰

Establishing PCAST

In October 2019, President Trump issued an Executive Order reestablishing the President's Council of Advisors on Science and Technology (PCAST).²²¹ In June 2020, PCAST issued its inaugural report recommending actions to strengthen U.S. leadership in IotF.²²²



Caption: OSTP Director and PCAST Chair, Kelvin Droege, and several members of PCAST at a meeting in February 2020. (Note not all members of PCAST are present.)

Credit: OSTP

Additionally, under President Trump's leadership, a first-of-its-kind advisory group consisting of students, post-doctoral scholars, and early career professionals (SPEC) was created as part of PCAST. SPEC was initiated in 2020 to integrate the perspectives of students at 2-year and 4-year institutions, graduate students, and early career professionals in STEM fields into PCAST's work. As future leaders of America's research enterprise, SPEC members contribute their unique perspectives into the current challenges and opportunities they face in STEM fields, and they offer input to PCAST on how to strengthen STEM education and STEM as a career field.



Caption: Members of the PCAST Students, Postdoctoral Scholars, and Early Career (SPEC) Professionals Subcommittee on a virtual conference in October 2020.

Credit: Emily Rinko/SPEC

America Joins the One Trillion Tree Initiative

“It has been a priority of my Administration to promote healthy and resilient forests. I was proud to announce earlier this year that the United States will be joining the One Trillion Trees Initiative, a global effort to restore, grow, and better manage one trillion trees around the world by 2030. Our efforts will lead to cleaner air and water, create wildlife habitat, and reaffirm our Nation’s commitment to conserving the majesty of God’s creation and the natural beauty of our world.”

Donald J. Trump, President of the United States

On January 21, 2020, President Trump announced that to further protect the environment, the United States would join the World Economic Forum’s One Trillion Trees Initiative, an ambitious global effort to grow and conserve one trillion trees worldwide by 2030. Healthy forests support natural stream systems and watersheds, filtering drinking water for 180 million Americans. Our national forests are an important source of rural prosperity, providing forest industry jobs to more than 2.5 million Americans. The national forests and grasslands support more than 46 million fishing visits annually, generating over \$2 billion in revenues, supporting about 51,000 jobs, and generating more than \$264 million in Federal taxes.²²³

With the strong support of President Trump and the USDA Forest Service, the One Trillion Trees U.S. Chapter launched²²⁴ in August 2020 with over two dozen U.S.-based companies, nonprofit organizations and governments pledging to conserve, restore and grow more than 855 million trees by 2030.²²⁵ In October 2020, the President signed an Executive Order “Establishing the One Trillion Trees Interagency Council.”²²⁶ The Council is “charged with developing, coordinating, and promoting Federal Government interactions with the Initiative with respect to tree growing, restoration, and conservation, and with coordinating with

key stakeholders to help advance the Initiative.” U.S. participation in the Initiative will enhance the long-term resilience of national forests by planting trees and restoring ecosystems over the next 10 years.

Improving Weather Modeling and Forecasting

President Trump has taken several actions to protect Americans’ lives and livelihoods from extreme weather events, drought, and other weather-related threats. Under the President’s leadership, NOAA launched multiple cutting-edge weather satellites. The first two of the new series of geostationary operational environmental satellites (GOES), GOES-16 and GOES-17, became operational in 2017 and 2019, respectively.²²⁷ Together, they provide faster, more accurate, and more detailed observations used by forecasters to protect the public.

In April 2017, President Trump signed the first major piece of weather legislation since the early 1990s—the “Weather Research and Forecasting Innovation Act.”²²⁸ The legislation includes reforms to Federal forecasting to improve seasonal forecasting, monitoring and clearly communicating information about extreme weather events, and the use of commercial data. In August 2020, NOAA released a Request for Proposal (RFP) for the first purchase of space-based commercial radio occultation (RO) data for use in NOAA’s operational weather forecasts.²²⁹ The data will have a positive effect on NOAA’s forecasting capability and better protect lives and property.

Federal Agencies in Action: Improving Tornado Forecasting to Save Lives and Property

Between June 2018 and May 2020 NOAA warned the public about several EF-3 or greater tornado events in advance of any damage or loss of life. Although several powerful tornadoes occurred at night and in populated areas, NOAA’s warnings minimized loss of life for these events. On December 1, 2018, 29 tornadoes swept across Illinois—the largest late-season outbreak since 1957. NOAA meteorologists provided decision support two days in advance, working with the emergency managers who directly attributed hundreds of lives saved thanks to NOAA’s services.

In January 2019, President Trump signed the “National Integrated Drought Information Reauthorization Act,”²³⁰ revitalizing American weather programs to protect lives and property. The legislation directs targeted investment in weather research and creates the Earth Prediction Innovation Center (EPIC), which will unleash the private sector and academic research community to develop new and emerging technologies into forecast operations, improving NOAA’s ability to protect lives and property.

In June 2019, NOAA implemented the first upgrade to the dynamic core of the U.S. global weather forecast model since 1980—the Finite-Volume Cubed-Sphere (FV3).²³¹ This upgrade will drive global numerical weather prediction into the future with improved forecasts of severe weather, winter storms, and tropical cyclone intensity and tracking. Ultimately, this upgrade will boost forecast accuracy across the country and help the U.S. reclaim international leadership in weather prediction.

Lastly, On October 16, 2020, the Joint Center for Satellite Data Assimilation (JCSDA) announced the first public, open-source release of the Joint Effort for Data assimilation Integration (JEDI) system on October 28, 2020.²³² JEDI-FV3 is a community effort that will serve as a unified and versatile data assimilation (DA) system for Earth system prediction. It is designed for a variety of purposes, from teaching and learning DA fundamentals to the development and validation of new DA algorithms and observational operators, to leading-edge atmospheric and oceanic research, to operational weather forecasting.

Advancing Nuclear Energy Technologies

“We will bring new opportunity to the heartland, new prosperity to our inner cities, and new infrastructure all across our nation. When it comes to the future of America’s energy needs, we will find it, we will dream it, and we will build it.”

Donald J. Trump, President of the United States

In January 2019, President Trump signed into law the “Nuclear Energy Innovation and Modernization Act” (NEIMA).²³³ NEIMA provides greater public clarity into the Nuclear Regulatory Commission (NRC) budgetary process and cost recovery. The bill requires the NRC to establish metrics and milestones for licensing and other regulatory actions as well as a regulatory framework for America’s innovators, who seek to develop, license, and deploy advanced nuclear technologies.²³⁴ In September 2018, President Trump also signed into law the “Nuclear Energy Innovation Capabilities Act,” (NEICA) the first stand-alone nuclear innovation legislation.²³⁵ The law calls for DOE to build a Versatile Neutron Source and to establish a National Reactor Innovation Center (NRIC) so that our innovators can build pre-commercial reactor prototypes here in America.

In August 2019, DOE announced the launch of the NRIC.²³⁶ The NRIC will provide private sector technology developers the necessary support to test and demonstrate their reactor

concepts and assess their performance. This will help accelerate the licensing and commercialization of these new nuclear systems.

In February 2019, DOE announced its plans to build a Versatile Test Reactor (VTR), fulfilling a requirement of NEICA.²³⁷ This capability will help accelerate the testing of advanced nuclear fuels, materials, instrumentation, and sensors. It will also allow DOE to modernize its essential nuclear energy R&D infrastructure and conduct crucial advanced technology and materials testing necessary to re-energize the U.S. nuclear energy industry. The project is being led by Idaho National Laboratory in partnership with five National Labs and industry and university partners. In September 2020, DOE announced that it approved Critical Decision 1—the second step in the formal process DOE uses to review and manage research infrastructure projects.²³⁸



Caption: Cutaway of the Versatile Test Reactor, a one-of-a-kind scientific user facility that will support R&D of innovative nuclear energy technologies.

Credit: Image courtesy of Idaho National Laboratory

In April 2020, DOE released a “Strategy to Restore American Nuclear Energy Leadership.”²³⁹ This strategy is the result of the Nuclear Fuel Working Group, established by the President in July 2019. The President recognizes that the United States needs a strong civil nuclear industry to ensure national security, and that the sustainability of this industry is tied to the entire nuclear energy supply chain. As a result, this strategy takes a whole of government approach to support a healthy and growing nuclear energy sector, from mining to the next generation of nuclear energy technology. Executing this strategy will help America regain its leadership position in the nuclear energy industry, protecting American jobs, technology, and national security.



Caption: U.S. Secretary of State Mike Pompeo (second from left) and Minister Adonis Georgiadi (second from right) sign the U.S. – Greece Science and Technology Agreement. U.S. CTO Michael Kratsios (far left) joined Secretary Pompeo.
Credit: OSTP

Advancing Earth System Predictability

The ability to predict extreme environmental events, such as severe storms, floods, droughts, and winter weather, has enormous economic and security implications. Although current predictive capabilities have advanced significantly during the past two decades, especially for forecasts out to a few days, our understanding of the predictability of certain phenomena is limited.

The White House highlighted Earth system predictability (ESP) in its FY 2021 and FY 2022 R&D Budget Priorities Memoranda.²⁴⁰ Since then, OSTP established an NSTC Fast Track Action Committee on ESP, solicited input from the community via an RFI, and engaged with stakeholders on this important issue. A better understanding of predictability will improve predictions themselves and aid in assessing their practical value. Further, it will help guide investments toward phenomena that are most predictable and thus yield the greatest return on taxpayer dollars.

Human Trafficking and Child Exploitation

Key research initiatives have led to the DHS S&T development of innovative digital forensics tools deployed to Federal, State and local law enforcement used to battle against perpetrators of human trafficking and child exploitation around the globe. These new technologies are a direct result of the January 2020 Executive Order on “Combating Human Trafficking and Online Child Exploitation”²⁴¹

as well as the DHS “Strategy to Combat Human Trafficking, the Importation of Goods Produced with Forced Labor, and Child Sexual Exploitation.”²⁴²

Fostering International S&T Engagement

Throughout the first term, the Trump Administration has advanced international S&T engagement in a way that yields maximal benefits for the American people. For example, in September 2020, the United States and Greece signed a new S&T Cooperation Agreement to enhance research and development collaboration between the two nations.²⁴³ The agreement promotes U.S.–Greece R&D activities across government agencies, universities, research institutions, and private sector companies from both countries. This S&T agreement represents the first such agreement between the United States and Greece in more than 40 years.

OSTP has also represented American positions as head of delegation at the G20 technology ministerial meetings, worked with our allies to advance technology issues of mutual importance as head of delegation at the G7 technology ministerial meetings, assisted in the negotiation of the landmark digital trade provisions of the United States-Mexico-Canada Agreement (USMCA), and has driven bilateral S&T engagement, including with key partners such as the UK, Japan and Ireland.²⁴⁴



Since coming into office, President Trump has solidified America’s standing as the most scientifically and technologically advanced Nation the world has ever known. This document has summarized only a small fraction of the many achievements made during the past 4 years by the Trump Administration and America’s extraordinary academic and private sector researchers and innovators.

The President signed into law substantial funding for R&D priorities that include industries of the future such as AI and quantum information science; space exploration; energy and the environment; national security; and health innovation and security. These priorities are supported by a commonsense regulatory agenda that is unleashing private sector innovation, through STEM education investments and workforce development aimed at leaving no Americans behind, and by enhanced international engagement with countries that share our values. Collectively, these efforts are creating new jobs, revolutionizing research, improving health, and enhancing economic and national security.

We live in a time of unprecedented achievement and potential but also considerable challenge as some individuals and governments seek to illicitly undermine our research efforts and reap the benefits of our hard work. This not only deprives American taxpayers the full returns on their investment, but it also erodes confidence in our research enterprise and undermines our economic and national security. To address this and other critical issues affecting our research enterprise, The White House launched the Joint Committee on the Research Environment, or JCORE. The goal of JCORE is to ensure our research environments are well defended and reflect American values. The American research enterprise should operate with maximum integrity, balance security with openness and international collaboration, embrace the best talent from every background, and minimize excessive regulations on researchers, agencies, and institutions.

A strong, world-leading American S&T enterprise has never been more important. Since the onset of the pandemic earlier this year, science and technology have served as our most valuable weapons in the fight against SARS-CoV2 and COVID-19. Operation Warp Speed, public-private partnerships, and other decisive actions taken by the Trump Administration have provided American scientists, engineers, and healthcare professionals with the knowledge, tools, and technologies needed to understand and defeat this “invisible enemy.” President Trump’s whole-of-Nation approach to combating COVID-19 already is paying enormous dividends in the form of novel treatments, enhanced diagnostics, and several promising vaccine candidates, all delivered with record speed while maintaining safety and transparency.

Despite the severe disruption caused by an unprecedented pandemic, we stand on the cusp of even more remarkable achievements. Innovators are leveraging decades of fundamental research discoveries to create quieter aircraft capable of supersonic flight. Scientists are exploring and mapping new underwater frontiers, testing the boundaries of predictability within the Earth system, and modeling the entire structure of a living cell. And President Trump is continuing America’s rich history of environmental stewardship, working to protect our land, air, and water all while increasing innovation and improving our economy.

After reading these highlights, I hope you share my excitement about the future of America’s S&T enterprise! We have made tremendous progress during the President’s first term to maintain American scientific preeminence while battling a global pandemic. I have no doubt that the actions taken by the Trump Administration over the past four years have solidified America’s position as the global S&T leader and has laid a strong foundation for the decades to come.

Kelvin K. Droegemeier
Director, The White House Office of Science and Technology Policy

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