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MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

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SUBJECT: Multi-Agency Science and Technology Priorities for the FY 2017 Budget

Scientific discovery, technological breakthroughs, and innovation are the primary engines for expanding the frontiers of human knowledge and are vital for responding to the challenges and opportunities of the 21st century. The Nation depends on science, technology, and innovation to promote economic growth and job creation, maintain a safe and sufficient food supply, improve the health of Americans, move toward a clean energy future, address global climate change, manage competing demands on environmental resources, and ensure the Nation's security.

Federal government funding for research and development (R&D) is essential to address societal needs in areas in which the private sector does not have sufficient economic incentive to make the required investments. Key among these is basic research—the fundamental, curiosity-driven inquiry that is a hallmark of the American research enterprise and a powerful driver of new technology. Simply supporting research is not sufficient, however, Federal agencies should ensure that the results of that research are made available to other scientists, to the public, and to innovators who can translate them into the businesses and products that will improve all of our lives.

This memorandum outlines the Administration's multi-agency science and technology priorities for formulating FY 2017 Budget submissions to the Office of Management and Budget (OMB). The priorities covered in this memo require investments in R&D; science, technology, engineering, and mathematics (STEM) education; STEM workforce development; technology transfer; R&D infrastructure; and scientific-collection management. The priorities in this

memorandum build on priorities reflected in this Administration's past budgets and priorities directives.

Agencies should label the sections of their budget submissions that address priorities described below. Agencies engaged in complementary activities should consult with each other during the budget planning process to coordinate resources, maximize impact, and avoid inappropriate duplication, and they should include summaries of these discussions in their OMB budget submissions. Agency proposals aligned with multi-agency R&D priorities and demonstrating interagency coordination are more likely to be prioritized in FY 2017 Budget deliberations.

Multi-Agency R&D priorities

In the FY 2017 Budget, agencies should balance priorities to ensure that resources are adequately allocated for agency-specific, mission-driven research, including fundamental research, while focusing resources, where appropriate, on the following multi-agency research activities that cannot be addressed effectively by a single agency.

- Global climate change. Agencies should advance the goals and objectives of the 2012-2021 U.S. Global Change Research Program (USGCRP) Strategic Plan, as well as the complementary science agenda that underpins the President's Climate Action Plan. Agencies should prioritize activities that foster the development and use of actionable data, information, and related tools needed to prepare for and reduce climate-related risks and should prioritize investments that support technical assistance for community climate-preparedness efforts.
- Clean energy. The President has stated a goal for the United States to lead the world in clean energy. His Climate Action Plan outlines several key objectives in this domain that should be given priority in the 2017 Budget, including promoting American leadership in renewable energy (including manufacturing for these technologies and a modernized electric grid); unlocking innovation in other key clean energy technologies; building a clean and efficient 21st-century transportation sector; and cutting energy waste in homes, businesses, and factories. In transportation, there is a particular need to support R&D that can advance multiple transportation modes and fill knowledge and technology gaps. As part of this focus, agencies should also support technology development that has the dual benefit of reducing greenhouse gas (GHG) emissions and bolstering the resilience of our communities. For example, agencies might consider technology development that leverages renewable energy to power water desalination or purification – reducing the GHG footprint of drinking water and bolstering the resilience of communities in drought-prone areas.
- Earth observations. Earth-observation data are instrumental to services that protect human life, property, the economy, and national security, and advance understanding the Earth as a system. Federal agencies should advance the goals of the 2014 *National Plan for Civil Earth Observations*. Agencies are encouraged to accelerate the development and demonstration of innovative approaches for observations, including technology for low-cost satellites and disaggregated instrumentation. In addition, space weather observations and R&D are essential to address the growing societal needs for accurate and timely space weather information. Agencies should prioritize investments in space weather science and preparedness according to the 2015 *National Space Weather Strategy and Action Plan*.

- Advanced manufacturing and industries of the future. The Administration is committed to the continued strengthening of America's manufacturing sector. Agencies should prioritize programs that advance the state of the art in manufacturing, as described in the *National Strategic Plan for Advanced Manufacturing*. Agencies should also prioritize investments in enabling technologies that benefit multiple sectors of the economy, such as nanotechnology, robotics, the Materials Genome Initiative, and cyber-physical systems and their application to smart cities.
- Innovation in life sciences, biology, and neuroscience. Agencies should give priority to programs that support fundamental biological discovery research that could generate unexpected, high-impact scientific and technological advances in health, energy, and food security, particularly in the President's BRAIN Initiative, the *National Strategy for Combating Antibiotic Resistance*, and the *National Strategy for Biosurveillance* (e.g., infectious-disease forecasting capabilities). Priority should also be placed on research that seeks fundamental principles that cut across habitats and biological systems, such as those that govern the behaviors of microbiomes in diverse environments. Agencies should prioritize research – guided by the *National Research Action Plan for Improving Access to Mental Health Services for Veterans, Service Members, and Military Families* – to identify and develop effective diagnostic and treatment methodologies and metrics with the aim of improved mental health and reduction in substance-use disorders. In addition, the Administration has committed to launching the Precision Medicine Initiative, aimed at tailoring medical care to the individual patient. Agencies should support investments on improving interoperability of health records, addressing privacy concerns, and launching research that will enable discoveries derived from Big Data.
- National and homeland security. National and Homeland Security and Intelligence mission agencies should invest in science and technology to meet the threats of the future and develop innovative new security capabilities. In order to better understand threats and prioritize investments, agencies should build on recent efforts to integrate and coordinate intelligence gathering and analysis focused on science, technology, and innovation, and assure those efforts are adequately resourced. Priority should be given to investments to develop capabilities in countering weapons of mass destruction, addressing the immediate risks to our national security posed by climate change, handling large data sets for national security mission requirements, advancing hypersonics, and developing accelerated training techniques.
- Information technology and high-performance computing. Agencies should prioritize research guided by the *Trustworthy Cyberspace: Strategic Plan for Cybersecurity R&D Programs* to develop technologies that can protect U.S. systems against cyber-attacks. Agencies should coordinate with each other and with the private sector to promote innovation in high-performance computing; modeling and simulation; and advanced hardware technology to support national security, scientific discovery, and economic competitiveness. Agencies should also give priority to investments that address the challenges and opportunities afforded by the expansion of Big Data to advance agency missions and further scientific discovery and innovation while providing appropriate privacy protections for personal data.
- Ocean and Arctic issues. Member agencies of the National Ocean Council should give priority to investments in science and technology that support the *National Ocean Policy*

Implementation Plan and responsible ocean stewardship, including observations, modeling, and data accessibility needed to support ecosystem-based management, as well as to advance understanding and inform responses to current and future climate impacts on oceans, Great Lakes, and surrounding communities. Agencies should also advance the objectives of the *Interagency Arctic Research Policy Committee Arctic Research Plan (FY 2013-2017)* and the newly-created Arctic Executive Steering Committee, which coordinates efforts on Arctic science, resource management, conservation, indigenous peoples, and international engagement through the 2015-17 U.S. Chairmanship of the eight-nation Arctic Council.

- **R&D for informed policy-making and management.** A diverse range of agency missions (e.g. natural resource management protecting health and the environment; global health security needs to prevent, detect, and respond to emerging infectious diseases) benefit from R&D that strengthens the scientific basis for decision-making. In order to maximize the societal benefits of R&D investments, research planning and design should be guided by stakeholder and user engagement. Both mission-centered agencies and R&D agencies should focus on creating user-driven information and tools that enable the translation of scientific observations to decision-making frameworks.

R&D Infrastructure

Agencies should support the R&D infrastructure (e.g. facilities, platform technologies, IT, digital tools) needed to ensure that U.S. science and engineering remain at the leading edge, and leverage resources from other agencies, state and local governments, the private sector, and international partners. Proposals for development, construction, and operations costs for new facilities must be fully justified and balanced against funding for ongoing programs and operations of existing facilities. In addition, agencies should take steps to ensure that underused existing facilities are made available to additional users through transparent and competitive methods.

Other R&D Program Guidance

Transforming research results and technologies to new products and services is a key step in realizing the economic and quality-of-life improvements the taxpayer expects from Federal investments in R&D. Commercialization of Federal R&D is therefore one of the core responsibilities of each R&D supporting agency. Agency budget proposals should prioritize and highlight contributions to the Lab-to-Market Cross-Agency Priority Goal, such as entrepreneurial personnel exchanges, commercialization training, and other programs that have the potential to accelerate and improve the transfer of new technologies from the laboratory to the marketplace.

In accordance with OMB Circular A-11 and the GPRA Modernization Act of 2010, agencies should describe the targeted outcomes of R&D programs using meaningful, measurable, and quantitative metrics where possible and describe how they plan to evaluate the success of those programs. Agencies should consider opportunities for improved measurements of R&D activities and outcomes by linking management and financial information about R&D in their DATA Act implementation plans. Agencies are encouraged to collaborate and identify best practices for linking management information on R&D with budget and financial data.

Agencies are encouraged to use approaches to foster innovation such as Grand Challenges, incentive prizes, citizen science, and collaboration with members of the Maker Movement.

Preserving and improving access to scientific collections, research data, other results of Federally-funded research, open datasets, and open educational resources should be a priority for agencies.

Agencies should ensure that Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) awards and programs contribute to the above multi-agency science and technology priorities.

Following engagement with stakeholders, agencies should implement policies and prioritize activities to improve the reproducibility of research in the fields they support.

STEM Education Guidance

Investments in STEM education should be guided by the priorities outlined in the *Federal STEM Education 5-Year Strategic Plan* developed by the Committee on STEM Education under the National Science and Technology Council, and should continue to pursue the goals of enhancing program effectiveness and reducing program fragmentation. Priority should be given to programs that use evidence to guide program design and implementation or that build evidence about what works in STEM education, using appropriate metrics and improving the measurement of outcomes. Agencies should give priority to policies and actions identified by research as having the greatest potential to increase inclusion and diversity in STEM education, research, and careers such as changes in STEM instruction; changing the image of STEM education and careers; and reducing explicit, implicit, and structural biases against girls, women, and members of underrepresented minority groups.