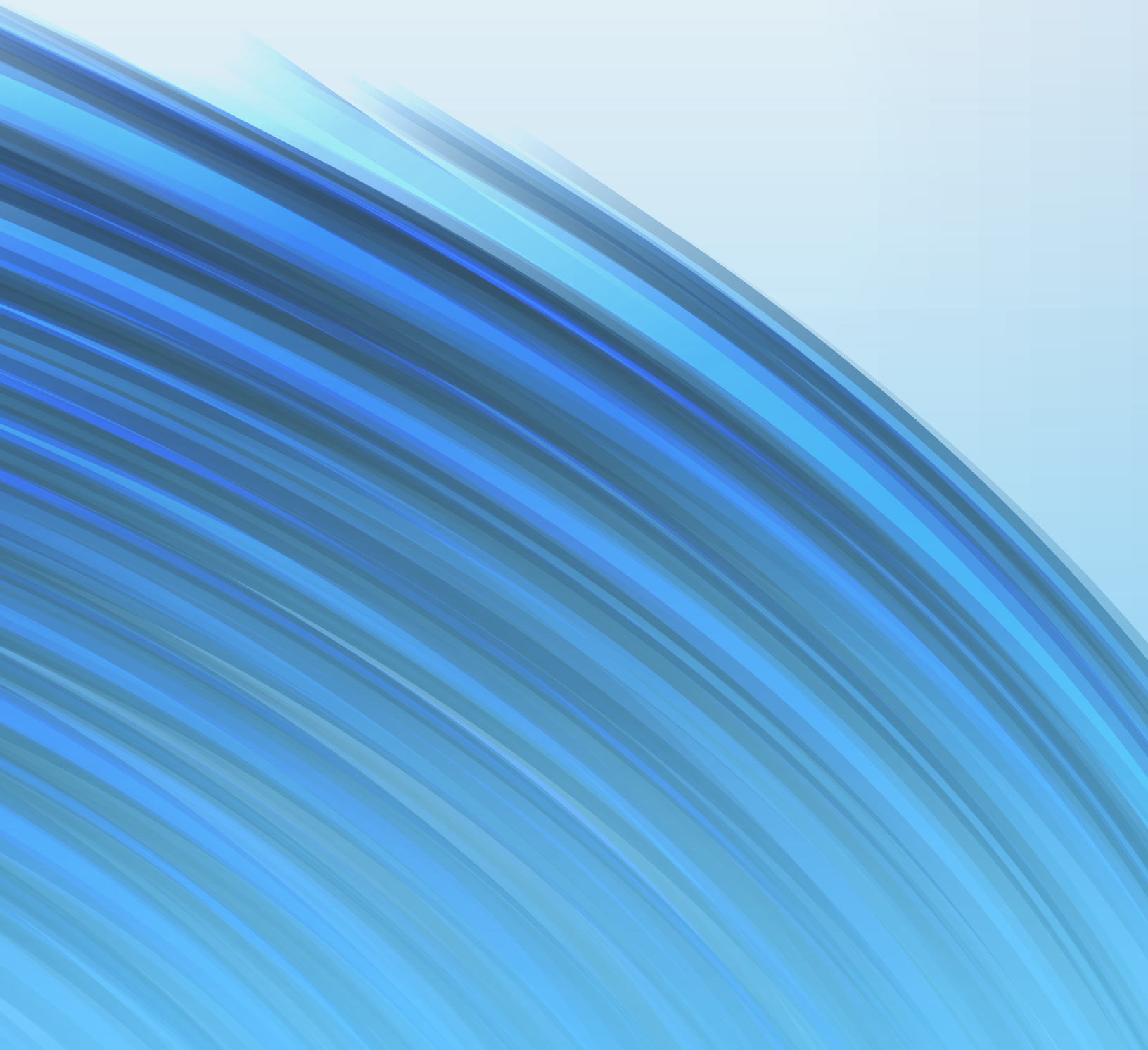
IDA SCIENCE AND TECHNOLOGY POLICY INSTITUTE

REPORT TO THE PRESIDENT FISCAL YEAR 2023



The Institute for Defense Analyses is a nonprofit corporation that operates three Federally Funded Research and Development Centers. Its mission is to answer the most challenging U.S. security and science policy questions with objective analysis, leveraging extraordinary scientific, technical, and analytic expertise.

REPORT TO THE PRESIDENT
FISCAL YEAR 2023

LETTER FROM THE DIRECTOR

Dear Mr. President:

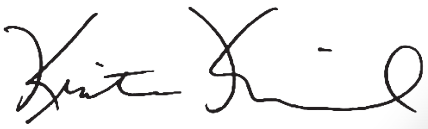
On behalf of the IDA Science and Technology Policy Institute (STPI), I am proud to present our report of activities for fiscal year 2023.

Congress established STPI as a federally funded research and development center in 1991 to inform policy decisions of the Office of Science and Technology Policy (OSTP) in the Executive Office of the President and expanded STPI's mission in 1998 to include:

- Reporting on significant trends and developments in science and technology in the United States and abroad,
- Analyzing those trends with attention to the Federal science and technology portfolio, and
- Performing studies that will ensure the long-term strength of American science and technology.

Since 2003, we have been operated by the nonprofit Institute for Defense Analyses with sponsorship through the National Science Foundation. We also work with other Federal agencies to inform science and technology policies and assess their effectiveness, including the National Science Foundation, the National Aeronautics and Space Administration, the National Institutes of Health, the Department of Labor, and the United States Agency for International Development.

It is my pleasure to deliver this report showing off the depth of knowledge at STPI and the diverse array of issues we have tackled over the past year. Everyone at STPI is deeply committed, both individually and as an institution, to providing OSTP and Federal agencies with in-depth, objective, fact-based analysis on a wide variety of science and technology topics and trends with complete discretion and free of conflicts of interest. On behalf of everyone at STPI, I thank you for the opportunity to help keep America at the forefront of scientific discovery and ensure that American science and technology continues to lead the world in innovation and technical progress.



Kristen M. Kulinowski

ABOUT THE SCIENCE AND TECHNOLOGY POLICY INSTITUTE

The Science and Technology Policy Institute (STPI) was established by Congress in the National Defense Authorization Act for Fiscal Year 1991 (P.L. 101-510) as a federally funded research and development center (FFRDC) under the name Critical Technologies Institute. In 1998, Congress renamed the Institute as part of the National Science Foundation Authorization Act of 1998 (P.L. 105-207), which also assigned STPI the following duties:

- Assembly of timely and authoritative information regarding significant developments and trends in science and technology research and development in the United States and abroad.
- Analysis and interpretation of the information with particular attention to the scope and content of the Federal science and technology research and development portfolio as it affects interagency and national issues.
- Initiation of studies and analyses of alternatives available for ensuring the long-term strength of the United States in the development and application of science and technology.
- Provision, upon the request of the Director of the White House Office of Science and Technology Policy (OSTP), of technical support and assistance
  - to committees and panels of the President's Council of Advisers on Science and Technology, and
  - to interagency committees and panels of the Federal Government concerned with science and technology.

Consistent with congressional direction, STPI provides analyses of significant science and technology policies and developments in the United States and abroad for OSTP, its primary sponsor, and for other Federal Government organizations with science and technology responsibilities. To ensure the continued relevance of its work, STPI meets frequently with the Director and staff of OSTP. Such close coordination—coupled with a flexible tasking process—ensures that STPI focuses on OSTP's top priorities and emergent problems.

To address STPI's broad science and technology charter, STPI researchers possess educational training and professional experience across the spectrum of disciplines and sectors. The majority of degrees among STPI's research staff are in mathematics, physical and life sciences, and engineering, with law, social science, communication, and history rounding out the staff's educational background.

CONTENTS

FEDERAL SCIENCE AND TECHNOLOGY ENTERPRISE

Support for the President's Council of Advisors on Science and Technology

The President's Council of Advisors on Science and Technology (PCAST) is an advisory group composed of "distinguished individuals and representatives" from industry, academia, and nonprofits with "diverse perspectives and expertise in science, technology, and innovation." PCAST advises the President "on matters involving policy affecting science, technology, and innovation, as well as on matters involving scientific and technological information that is needed to inform public policy relating to the economy, worker empowerment, education, energy, the environment, public health, national and homeland security, racial equity, and other topics." The White House Office of Science and Technology Policy (OSTP) asked the Science and Technology Policy Institute (STPI) to provide technical support to PCAST in the form of background research, information gathering and analysis, identification of key issues for PCAST consideration, and technical review and writing support. STPI provided such support for 10 PCAST working groups, including technical input, writing, or review for each of the 7 PCAST reports released in FY 2023:

1. *Biomanufacturing to Advance the Bioeconomy,*
2. *Modernizing Wildland Firefighting to Protect Our Firefighters,*
3. *Extreme Weather Risk in a Changing Climate: Enhancing prediction and protecting communities,*
4. *Supporting the U.S. Public Health Workforce,*
5. *The Seventh Assessment of the National Nanotechnology Initiative,*
6. *Advancing Public Engagement with the Sciences,* and
7. *A Transformational Effort on Patient Safety.*

Other contributions in 2023 include assistance in organizing a Cyber-Physical Resilience Symposium to convene key stakeholders and inform PCAST working group efforts. STPI researchers continue to conduct analyses and assist in report development for PCAST and its current working groups on topics ranging from the vibrancy of basic research to the future of groundwater.

International Science and Technology Cooperation Biennial Report 2024

The International Science and Technology Cooperation Act of 2016, part of the American Innovation and Competitiveness Act, instructs the Director of OSTP to submit a biennial report on U.S. Government international science and technology cooperation efforts to the Senate Committees on Commerce, Science, and Transportation and Foreign Relations and the House Committees on Science, Space, and Technology and Foreign Affairs. OSTP asked STPI to support the National Science and Technology Council (NSTC) Subcommittee on International

Science and Technology Coordination in preparing the 2024 report. In addition to helping facilitate and manage the preparation of the 2024 report, STPI was also asked to conduct research addressing two recommendations from the Subcommittee's 2022 report: (1) to understand why science, technology, engineering, and mathematics (STEM) talent leaves the United States and (2) to explore how researchers at Historically Black Colleges and Universities (HBCUs), Minority Serving Institutions (MSIs), and institutions in Established Program to Stimulate Competitive Research (EPSCoR) jurisdictions are participating in international science and technology collaborations. STPI prepared two original research reports on the requested topics. The first developed and populated a model of flows of foreign and domestic STEM talent in different scientific disciplines and with different levels of education and experience into, out of, and through the U.S. STEM ecosystem. The second report used bibliometric data to rigorously analyze co-authorship of researchers at HBCUs, other MSIs, and EPSCoR institutions with foreign collaborators. Both STPI reports were publicly posted to support the congressionally mandated report on International Science and Technology Cooperation, which was released in February 2024.

Analysis of Federal Workforce Requirements for Continuity Communications

The National Security and Emergency Preparedness (NS/EP) Communications Group Interagency Policy Committee (IPC), which is co-chaired by the National Security Council (NSC) and OSTP, provides guidance and strategic direction to coordinate, advise, and recommend policy and technical standards for NS/EP communications systems, services, and underlying infrastructure. OSTP asked STPI to assess the duties and activities staff are required to perform, and the staffing levels and training required to maintain the capabilities for operating NS/EP communications networks, consistent with other Federal mission resilience efforts. The STPI team prepared a report describing the results of interviews to summarize staffing, certifications, and training required to maintain Federal continuity communications included in OMB-OSTP Directive D-16-1. The report was distributed to the IPC in November 2023. OSTP used the results of the report to inform updates to the minimum requirements for relevant continuity communications capabilities.

Report on Implementation of Federal Prize and Citizen Science Authority

The America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (COMPETES) Reauthorization Act of 2010 granted broad authority to all Federal agencies to conduct prize competitions to encourage fresh perspectives, novel approaches, and collective problem-solving intended to spur innovation and ingenuity. The complementary American Innovation and Competitiveness Act, which became law in January 2017, gave Federal agencies broad authority to use crowdsourcing—and specifically citizen science—to advance agency missions and facilitate broad public participation in the innovation process. OSTP is required by these Acts to submit a biennial report to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science,

Space, and Technology of the House of Representatives on the activities carried out under these two authorities. OSTP asked STPI to help compile information prize competitions and crowdsourcing/citizen science projects conducted by agencies across the Federal Government in FY21 and FY22. As part of this effort, STPI has continued to revise and improve the data collection process to allow more rigorous analysis of relationships among the submissions as well as reduce the effort required by each agency to prepare a submission.

Supporting the Committee on Foreign Investment in the United States

The Committee on Foreign Investment in the United States (CFIUS) is an interagency committee authorized to review certain transactions involving foreign investments in the United States and certain real estate transactions by foreign persons, in order to determine the effect of such transactions on the national security of the United States. OSTP is a CFIUS member agency. STPI works with OSTP to inform their ongoing review of CFIUS transactions as well as other workflows.

SPACE TECHNOLOGY AND POLICY

Space Security

The *United States Space Priorities Framework*, released December 2021, states that "intensifying strategic competition presents a serious threat to U.S. national security interests, including in space." In response, the U.S. Government seeks to develop space policies that address its national security interests as well as its broader range of strategic interests in space and ensure that adequate whole-of-government approaches exist to address both emerging threats and the challenges of technological change. OSTP asked STPI to research and propose options that may improve the ability of the United States to respond to an evolving space security environment and to support OSTP's dissemination of chosen options. STPI prepared two memos, one proposing options for responding to novel counterspace threat technology and the other proposing options for responding to novel space security threats. The sponsor used the products developed by STPI as the basis for wider engagements across Federal agencies to begin considering how the United States can address the concerns raised in the *United States Space Priorities Framework*.

Cislunar Governance

In November 2022, OSTP released the first *National Cislunar Science and Technology Strategy* to advance U.S. leadership in cislunar space, which includes as a key objective the expansion of international science and technology cooperation to "foster peace, develop responsible practices, and create the foundations for new institutions to enable enduring human and robotic presence in cislunar space." The strategy amplifies ongoing work to advance the Artemis Accords, a U.S.-led initiative to put in place a common set of principles to govern the civil exploration and use of outer space. However, with an expanding list of nations planning and carrying out activity on the Moon's surface and in cislunar space, the possibility of misunderstandings or conflicts are increasing. OSTP asked STPI to study what rules-based governance frameworks could be pursued as well as how they could be implemented. To fully explore possible cislunar governance mechanisms, STPI reviewed existing literature, convened several workshops of experts to solicit input, and developed a series of options and scenarios for cislunar governance along with an analysis of the strengths, weaknesses, opportunities, and threats associated with each. STPI's research is being used by OSTP to develop a framework capable of governing the anticipated increase in international lunar surface activity.

Russian Space Development

Since 1957, Russia has been at the forefront of the world's most prolific space programs supporting civil, socioeconomic, and military needs. Russia possesses a large space enterprise and operates a wide variety of spacecraft and launch vehicles. Russia remains a top-tier space power despite economic hardships and technological challenges, and has publicly committed to maintaining its role as a global space leader. The Office of the Director of National Intelligence requested that STPI research and synthesize unclassified information on Russian space development and the anticipated trends, programs, and areas of interest for Russia over the next decade. The study specifically addresses what space capabilities Russia seeks to develop and acquire in the near- and long-term future, the biggest challenges facing the Russian space

enterprise in the near- and long-term future, which Russian space companies are poised to emerge as industry leaders within Russia, and how Russia views itself relative to the United States in the space domain. STPI produced a report on anticipated developments and future trends in the Russian space sector, with some focus on Russia's space commercial sector.

Technical and Analytical Support for OSTP Space Weather Activities

Space weather encompasses a wide array of phenomena that can have severe effects on national security assets and the Nation's critical infrastructure, including assets in space. In recognition of this threat, the Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow (PROSWIFT) Act assigns roles and responsibilities to agencies involved in space weather research and forecasting and codifies coordination within the government to better predict severe space weather events and mitigate their impact. The Act established the Space Weather Advisory Group and assigned it to conduct a survey to identify the space weather research, observations, forecasting, prediction, and modeling advances required to improve space weather products. OSTP asked STPI to assist the working group in this effort. STPI supported a 3-day hybrid Space Weather Workshop and carried out a series of focus group discussions covering specific areas of concern, such as the U.S. power grid, aviation, emergency management, and human space flight. Based on the information gathered from these discussions, STPI helped the working group draft a report on *Findings and Recommendations to Successfully Implement PROSWIFT and Transform the National Space Weather Enterprise* that was delivered to the White House Subcommittee on Space Weather Operations, Research, and Mitigation.

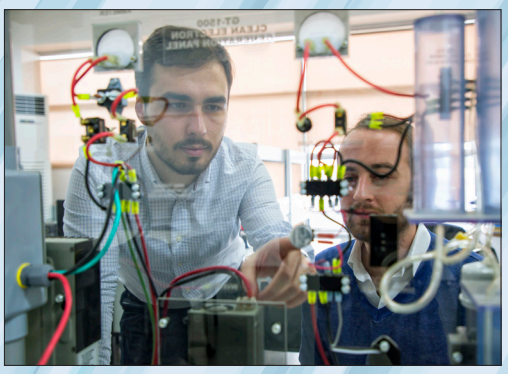
Space STEM Workforce Analysis

OSTP asked the Department of Labor (DOL) to provide information about the level of effort required to build rockets for transporting personnel and materials back and forth to build a base on the Moon. DOL possesses multiple sources of data on the current workforce in industries—including skills required, tasks performed, and projected future employment—but it does not generate hypothetical scenario-based projections based on future goals. STPI was asked to examine potential future workforce needs based on existing aerospace workforce data. DOL also sought to explore and test the use of emerging methods—including those using artificial intelligence (AI)—to make collection and interpretation of data more efficient in the evaluation of skills for new and emerging critical occupations in the science and technology workforce. STPI first reviewed existing literature to establish a set of working definitions of the space STEM workforce, which was used to identify space-specific STEM skills. STPI then explored Federal databases of skill-level workforce information as well as accessible data on job postings to determine what occupations require skills relevant to space STEM work.

Satellite Needs Survey and Analysis

OSTP, through the Satellite Needs Working Group (SNWG) of the NSTC's U.S. Group on Earth Observation (USGEO) Subcommittee, supports a biennial process to collect satellite measurement needs from Federal civil agencies. The objective of this process is to identify, collect, and transmit civil agency measurement requests to NASA for consideration in its systems engineering process. To support the fourth satellite needs survey, OSTP asked STPI to (1) provide appropriate technical assistance and program office functions and (2) contribute to the development of attendant technical and policy analyses. STPI's work complemented NASA's analysis of the survey data with respect to identifying interagency satellite needs. STPI facilitated, hosted, and documented 2022–2023 SNWG meetings; helped develop of the 2022 version of the survey based on agency feedback and lessons learned from the 2020 survey; and provided summary analysis of the results of the fourth satellite needs survey to the SNWG. The survey results are being used by NASA to allocate critical satellite resources used by numerous Federal agencies in fulfillment of their various missions.

STEM EDUCATION, WORKFORCE, AND TALENT



Foreign STEM Talent for Critical Technology Areas

Recruiting and retaining foreign-born STEM talent is critical to ensuring the economic and national security of the United States. In particular, the 2023 Defense Strategy emphasizes the importance of attracting global expertise to the defense science and technology workforce in critical technology areas (CTAs). The Federal Government has a strong interest in aligning immigration policy to help meet high priority needs in the U.S. STEM workforce. OSTP asked STPI to estimate current demand for defense STEM workers in CTAs and potential future shortfalls in the supply of these workers, with a focus on understanding the extent to which foreign-born STEM workers might be able to reduce these shortfalls if immigration policies were to be changed. Using publicly available data, STPI cross-tabulated different STEM degree fields against critical technology areas and then tallied both the total number of PhD degrees awarded in each field and the number awarded to temporary residents. Accounting for post-graduation retention, STPI compared the rate of STEM talent supply with demand from retirements and job openings. The implications of STPI's findings for meeting workforce demand was presented as a report delivered in August 2023.

Understanding and Advancing the Role of Early-Career Researchers in Advancing Open Science

The White House declared 2023 the *Year of Open Science* to advance "The principle and practice of making research products and processes available to all, while respecting diverse cultures, maintaining security and privacy, and fostering collaborations, reproducibility, and equity." The success of this policy will require not only ensuring a robust infrastructure to support open science, but also changing the culture of the U.S. research community. Early-career researchers will play a critical role in shaping the future of this enterprise. OSTP asked STPI to report on the needs, priorities, and perceived roles of the early-career research community in the open science and research ecosystem. STPI helped design and facilitate four listening sessions to engage early-career researchers and the communities that support them in the discussion of open science. The topics included the role of open science in their careers, obstacles to engaging in open science, benefits of open science, best practices for open science, and what the Federal Government can do to enable and support open science. In total, over 1,000 participants representing approximately 250 organizations attended the sessions and 117 comments were made. STPI completed the summary of the data collected in the sessions, which was used by OSTP in its reports to Congress.

Federal STEM Strategic Plan

The America COMPETES Reauthorization Act of 2010 requires OSTP/NSTC's Committee on STEM (CoSTEM) to prepare and implement a STEM strategic plan on a 5-year cycle. OSTP asked STPI to support CoSTEM's efforts to prepare a new strategic plan. STPI compiled and synthesized information from public listening sessions and a series of group discussions and roundtables addressing specific STEM issues to inform the content of the plan. In addition, STPI hosted a town hall at IDA's Potomac Yard headquarters for representatives of all the

Federal agencies represented on the Federal Coordination in STEM Committee to discuss the areas of focus for the plan and begin the process of writing. Following the town hall event, STPI convened and facilitated the writing teams to inform an initial draft of the plan, which will be used to guide Federal STEM education and workforce programming and policy over the next 5 years.

Hispanic and Latino STEM PhDs

The Consolidated Appropriations Act, 2023 directed the National Science Foundation (NSF) to "collaborate with stakeholders in preparing a report that investigates and makes recommendations about how to increase the rate of Hispanic Ph.D. graduates in STEM fields." In March 2023, NSF asked STPI to support preparation of this report by conducting a literature review of relevant statistical data and convening a series of stakeholder listening sessions. STPI found that despite making up 22% of the U.S. population, Hispanic or Latino/a students are underrepresented in science and engineering (S&E) fields, especially at the PhD level. In 2020, they made up only 9% of S&E PhD recipients. However, while Hispanic or Latino/a students are underrepresented in S&E fields, they are receiving bachelor's and PhD degrees in S&E fields at an increasing rate, and by 2035, the proportion of Hispanic or Latino/a students receiving S&E bachelor's degrees is expected to keep pace with their overall proportion of the U.S. population. Material from STPI's report to NSF, delivered in June 2023, was used by NSF in preparing its report to Congress.

Charting the Course for STEM Education of the Future: Challenges and Enduring Questions

NSF's Directorate for Education (EDU) seeks to achieve excellence in U.S. STEM education for all ages and in all settings. That excellence undergirds a well-prepared workforce of scientists, technicians, engineers, mathematicians, and educators and a well-informed citizenry. NSF asked STPI to support NSF staff engaging with representatives of the STEM education research and development (R&D) community and other STEM education stakeholders to explore possible future directions and venues for STEM learning and education and for the purpose of creating partnerships among educators, researchers, private foundations, and businesses. In 2023, STPI supported four workshops on CAREER awardees, blockchain in education, microelectronics education, and research topics regarding the undergraduate-to-graduate transition in STEM education. STPI also supported a set of three listening sessions addressing Hispanic-Serving Institutions, a set of two listening sessions about community colleges, and a listening session regarding low-income STEM students. In addition, STPI carried out analyses related to the portfolio of EDU Core Research (ECR) awards, including the demographics and award histories of principal investigators, the research conducted in ECR awards, and the publications resulting from those awards. All products were used by NSF as part of its internal strategic deliberations regarding future programmatic efforts.

BIOSCIENCES AND PUBLIC HEALTH

Biosafety and Biosecurity Analysis

OSTP, in coordination with NSC, developed a revised policy governing life science research of concern that combines and expands upon existing policies for *Dual Use Research of Concern and the Potential Pandemic Pathogen Care and Oversight* guidance. OSTP asked STPI for support while developing this revised policy. In support of this effort, STPI hosted two roundtables and a focus group and conducted additional interviews with institutional biosafety officers and life science researchers to gain an understanding of potential "sticking points" implementing the revised policy. STPI summarized findings into a final report. Next, STPI analyzed the responses to OSTP's Request for Information (RFI) on Potential Changes to the *Policies for Oversight of Dual Use Research of Concern (DURC)* and the *Potential Pandemic Pathogen Care and Oversight (P3CO) Policy Framework* and provided a summary report and a separate assessment of RFI responses related to specific policy topics. STPI also developed eight example research scenarios that could be used to "stress test" the revised policy framework and identify gaps in policy scope. In support of policy implementation, STPI conducted research on the number and nature of research compliance entities at U.S. institutions of higher education that could implement a revised policy. Finally, STPI assessed existing biological risk assessment tools and developed a detailed checklist intended to assist policy users. OSTP used this research, outreach, and analysis to inform the development of the revised policy and companion implementation guide.

Pandemic Innovation

OSTP asked STPI for research and analysis to inform the development of a potential OSTP Pandemic Prevention Plan. In support of this effort, STPI prepared multiple reports: (1) addressing examples of interventions previously shown to prevent the transmission of MERS and Ebola, (2) identifying potential data and datasets that could be used to show public health intervention efficacy, and (3) analyzing existing agencies, authorities, and non-governmental organizations that could be used to promote and deploy clean indoor air standards in areas where zoonotic disease transmission frequently occurs. Finally, STPI evaluated the Bipartisan Infrastructure Law and select Centers for Disease Control and Prevention program funding levels to identify existing funding streams that could be leveraged to support pandemic prevention efforts. This work was used by OSTP to inform the identification of priority lines of effort to be included in the OSTP Pandemic Prevention Plan.

Improving American Health Outcomes

In 2023, OSTP established a Health Outcomes Division to leverage the best of science, technology, and innovation to impact policies, programs, and initiatives across the Federal Government and through coordination of private sector opportunities to improve human health outcomes. This includes efforts to address health promotion; to prevent, manage, treat, and cure diseases and conditions; to stop the next outbreak from becoming a pandemic; to improve access to and quality of healthcare; and other steps that will contribute to equitably improved health outcomes for the American people. The objective of this project was to produce a report outlining which health outcomes metrics should be used to measure progress for the Health

Outcomes Division and to investigate factors that pose a threat to health outcomes and health equity. OSTP asked STPI to prepare a report compiling baseline statistics (e.g., morbidity and mortality) in the United States against which to measure progress (including disparities based on geography, race, gender, age, and sexuality), identify trends in relevant health outcomes and the factors that may influence them, and provide additional policy targets for OSTP focus.

Biotech Service Advancements

Executive Order (EO) 14081 on *Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe, and Secure American Bioeconom*y outlines actions that the Federal Government will take to develop innovative, bio-based solutions to challenges in health, climate change, energy, food security, agriculture, and supply chain resilience. However, advances in many of these areas—and particularly expanding the ability to manufacture custom bio-based products at scale—presents dual-use risks (i.e., they provide a clear benefit but could be misapplied to do harm). OSTP asked STPI to collect and analyze information related to two areas of advancement in biotechnology and biomanufacturing services: (1) services that provide made-to-order (genetically engineered) biological organisms, and (2) cloud lab services. STPI gathered information by conducting interviews with biofoundry and automated cloud lab service providers and delivered a memorandum that identified activities that could serve to improve biosecurity as availability of providers that offer made-to-order microorganisms and automated laboratory services continue to expand.

ENVIRONMENT

Evaluating Climate and Environmental Justice Tradeoffs

Addressing climate change and environmental justice are key goals for the Biden-Harris Administration, and it is possible that certain strategies or technologies to address climate change may negatively affect environmental justice for associated communities. OSTP asked STPI to explore potential environmental justice tradeoffs arising from technologies that may help meet climate goals. STPI first evaluated the Administration's EOs on environmental justice and climate, the published academic literature on environmental justice, and identified environmental justice concerns related to the development of the domestic electric vehicle battery market. Climate-related legislation has provided large financial incentives for the development of battery technology for electric vehicles, and many agencies have developed funding programs that require applicants to address environmental justice. However, STPI found that once an agency disburses funds, it often has little to no ability to assess whether environmental justice commitments are met. To more effectively address environmental justice, Federal agencies may need to prioritize location-specific approaches that build on interpersonal relationships within communities. OSTP used STPI's analysis to inform the development of the *Environmental Justice Science, Data, and Research Plan,* as mandated by EO 14096, *Revitalizing our Nation's Commitment to Environmental Justice for All.*

Earth Observation Assessment 2023

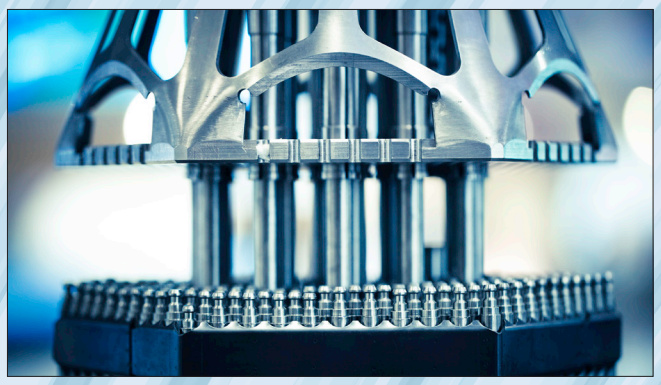
The 2010 NASA Authorization Act instructed the Director of OSTP to establish a mechanism to ensure greater coordination of civilian Earth observations. In response, OSTP established a process for a government-wide assessment of the Nation's Earth observation portfolio, which yielded the Earth Observation Assessment (EOA). The principal purpose of the EOA activity is to guide the development of the next National Plan for Civil Earth Observations and to "help coordinate federally supported Earth observations and investments, identify opportunities to advance Earth observations, and achieve national Earth observation policy objectives." EOA 2023 will update and refresh Climate and Agriculture and Forestry Societal Benefit Areas (SBA) of EOA 2016 with particular attention focused on key climate-related areas, such as wildfires, coastal resilience, agriculture, conservation, and renewable energy. STPI has played an integral part in previous EOAs and was asked to review and refresh the value tree for selected SBAs, coordinate and execute the collection of data from subject matter experts about the use of Earth observations across the Federal civil agencies related to climate and agriculture/forestry, and assist in the development of the EOA report. The *2023 Earth Observations Assessment Report: Overview and Methodology* was released publicly in July 2024.

USGEO National Planning for Civil Earth Observations

Earth observation systems provide crucial information on Earth processes, including data on land use/land cover, fires, coastal zone management, precipitation, and many related regions and fields of science. A robust infrastructure of these observations is necessary to inform policy and decisions on a number of critical topics, including climate, environmental and human health impacts, and extreme weather predictions. To ensure efficient use of resources and adequate coverage of observation variables for current and future needs, there is a need for a strongly

coordinated Federal approach. In October 2010, Congress charged OSTP to produce and routinely update the *National Plan for Civil Earth Observations*, a responsibility that is carried out by USGEO. OSTP asked STPI to support development of the next national civil plan on Earth observations by providing expertise, coordinating meetings and discussion, and writing internal reports and other briefing material. The plan is currently undergoing public comment.

EMERGING TECHNOLOGIES AND TECHNOLOGY TRANSITION



National Quantum Initiative Advisory Committee

The National Quantum Initiative Program was established in 2018 with the passage of the National Quantum Initiative Act (NQIA) to "ensure continued leadership of the United States in quantum information science and its technology applications." Among its provisions, the NQIA established the National Quantum Coordination Office within OSTP to, among other responsibilities, provide technical and administrative support for the National Quantum Initiative Advisory Committee (NQIAC), a Federal Advisory Committee charged with advising the President, the Subcommittee on Quantum Information Science of the NSTC, and the Subcommittee on the Economic and Security Implications of Quantum Science of the NSTC. STPI was asked to provide technical assistance to the NQIAC and its subcommittees in their work on the current U.S. and global landscape in quantum information science, infrastructure, industry, workforce, security, and international cooperation to inform the development of a new plan to advance quantum information science and technology in the United States. STPI support has included reviewing existing literature and datasets relevant to U.S. quantum information science characterizing the quantum workforce, synthesizing key takeaways from subcommittee conversations with stakeholders, and supporting the development of the NQIAC's report, *Renewing the National Quantum Initiative: Recommendations for Sustaining American Leadership in Quantum Information Science,* released in June 2023.

Assessing U.S. Capacity and Need for an Artificial Intelligence Scholarship for Service

The Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act of 2022 (P.L. 117-167) section 10313(d) required the Director of NSF, in coordination with the Office of Personnel Management, to create a report on the need for and feasibility of establishing a Scholarship for Service (SFS) program to recruit and train the next generation of AI professionals to meet the needs of Federal, State, local, and Tribal governments. NSF asked STPI to conduct research and analyses in three areas to inform the development of the NSF report, including recent statistical data on the size, composition, and educational requirements of the Federal AI workforce; the capacity of institutions of higher education to produce graduates with degrees, certifications, and relevant skills related to AI; and the need for establishing an AI SFS program similar to the existing NSF CyberCorps® SFS program. In FY 2023, STPI researchers gathered information and conducted analyses for these reports (to be completed in FY 2024), delivering a mid-project briefing with preliminary findings to NSF on September 20, 2023.

Opportunities for Micro and Modular Nuclear Reactors

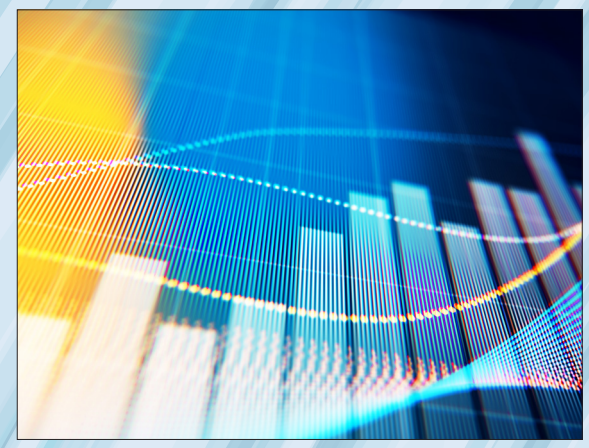
To achieve zero emissions of carbon dioxide from the electric power system, the United States will need to invest in and bring online facilities that can provide baseload power that does not emit greenhouse gasses (GHGs). Advanced Small Modular Reactors (SMRs; reactors with a power capacity of 50–300 megawatts) and microreactors (reactors with a power capacity of 10–20 megawatts) are garnering increased attention to serve in this role. OSTP asked STPI to provide a top-level assessment of the benefits, challenges, and opportunity costs of SMRs

as a source of GHG emissions-free electricity and of microreactors for lower capacity GHG emissions-free generation for backup and special purposes. STPI developed a framework of considerations to identify Federal facilities where an SMR or microreactor might be well suited, including costs, security, demand, grid connectivity, and public concern. Based on the framework of criteria, STPI identified 17 potential Federal facilities suitable for an SMR or microreactor. STPI also produced a separate document summarizing what planners at Federal agencies should be aware of if they are considering powering a facility with on-site nuclear power.

Resilience Science and Technology

To strengthen and promote national resilience against threats and hazards that could have catastrophic consequences to essential national functions, the NSTC Committee on Homeland and National Security established the Subcommittee on Resilience Science and Technology (SRST). OSTP asked STPI to provide analysis and support in conceptualizing, planning, and completing numerous SRST deliverables aimed at increasing national resilience through Federal science and technology coordination and innovation. In 2023, STPI helped the SRST develop three new research focus areas on (1) systemic resilience, (2) quantifying resilience investments, and (3) identifying linkages between U.S. resilience programs and international efforts. STPI also assisted in the establishment of a cyber-physical resilience interagency working group, designed to identify key research and technology needs to bridge gaps in this area, an effort that continues in 2024.

AGENCY PROGRAM DEVELOPMENT AND PORTFOLIO EVALUATIONS



Rubrics Development and Assessment of Engines Deliverables

The NSF Engines program aims to fund regional coalitions of partnering organizations that will catalyze technology and science-based regional innovation ecosystems. Each Engine is focused on addressing specific aspects of a major societal and/or economic challenge of significant interest in the Engine's defined "region of service." Each Engines awardee is tasked to develop a strategic and implementation plan to ensure proper organization, management, and planning to sustain the Engine. STPI was asked to develop rubrics to integrate with NSF's assessment and evaluation framework that is designed to holistically measure the NSF Engines program over the entire 10-year award period. In addition, STPI was asked to provide training to NSF program staff to implement the rubrics and conduct programmatic-level assessments.

Clinical Trials and Translational Research Advisory Committee Strategic Planning

In November 2019, the National Cancer Institute (NCI) convened a Strategic Planning Working Group (SPWG) to develop recommendations for realizing its vision for cancer clinical trials and improving the operational efficiency and reducing the cost of cancer clinical trials today and in the future. STPI provided strategic and analytical support for the SPWG, including drafting its 2020 report. Since that time, STPI has continued to assist NCI with implementation of the SPWG Report's recommendations by facilitating deliberations of the working group convened to advise on reducing data collection burden and promoting the integration of clinical trial activities with electronic medical record (EMR) systems. STPI has also provided support in drafting the final report to the Clinical Trials and Translational Research Advisory Committee (CTAC). Additionally, in 2023, STPI advised NCI on strategic approaches for implementing several other SPWG recommendations and facilitated discussions with NCI staff and extramural stakeholders concerning those approaches.

The National Clinical Trials Network, Community Oncology Research Program, and Scientific Steering Committees of the National Cancer Institute

To support its commitment to increase the diversity, inclusivity, and equitability of the cancer clinical trials workforce, NCI created the NCI Equity and Inclusion Program (EIP). The EIP formed a subcommittee to better understand and make recommendations to improve the representation of women and underrepresented groups in clinical trials leadership positions within the NCI National Clinical Trials Network, the NCI Community Oncology Research Program, and the NCI Scientific Steering Committees. In FY23, STPI designed and conducted a survey to establish a baseline description of the diversity of leadership across these entities and analyzed the responses. STPI presented the results to both the EIP Subcommittee and the CTAC.

Implementation of the National Cancer Institute Clinical Trials and Translational Research Advisory Committee Clinical Trials Informatics Working Group's Recommendations

STPI provided analyses and strategic guidance for implementing the recommendations of the NCI Clinical Trials Informatics Working Group (CTIWG) established by the NCI CTAC in 2015. CTIWG's purpose is to provide advice on NCI's Clinical Trials Reporting Program (CTRP) and to increase the usability and accessibility of CTRP clinical trial information. In FY23, STPI provided strategic and analytical support for NCI's development of a reporting tool designed to provide NCI Designated Cancer Centers with access to a subset of CTRP clinical trial information. STPI also analyzed current CTRP Primary Purpose classifications and determined that the current Primary Purpose categories are inconsistently implemented. Based on this analysis, STPI recommended a revised set of Primary Purpose categories with associated definitions and guidance on consistent implementation.

Strategic Planning Support for NSF Science and Technology Centers

Science and Technology Centers (STC) are one of NSF's flagship initiatives to support innovative, complex, and potentially transformative research and education projects that require large-scale, long-term awards. NSF asked STPI to conduct an external evaluation of the STCs funded between 2005 and 2016. The study will utilize mixed-methods to address the following questions: have the STCs conducted transformative research, contributed to the training of a diverse STEM workforce, and enabled dissemination, transfer, and application of knowledge to benefit science and society? What are the main legacies of the STCs? What changes to the STC program are warranted? In the past year, STPI completed interviews with STC directors and external experts, analyzed numerous administrative documents and data, and fielded a survey of participants. STPI gave multiple presentations to share progress with NSF, and will prepare a report summarizing the accomplishments of STCs and recommending ways to help NSF manage the program in the future.

Evaluation and Analytical Support for the National Institute on Aging

STPI is providing evaluation support to the Office for Policy Analysis and Evaluation at the National Institute on Aging (NIA). In the past year, STPI worked on three projects: (1) evaluation of the Alzheimer's Disease Sequencing Program, a $250+ million investment by NIA to identify genes and genetic loci associated with the risks of developing Alzheimer's Disease; (2) evaluation of NIA's Chartered Committees that review career development applications; and (3) development of the diversity, equity, inclusion, and accessibility strategic plan. STPI conducted dozens of interviews, focus groups, and listening sessions with NIA staff, intramural scientists, and the extramural community to gauge participant and stakeholder satisfaction and identify strengths and weaknesses. These studies will help NIA improve its programs, policies, and processes.

Evaluating the National Institutes of Health Director's Transformative Research Award's Anonymized Review Process

The National Institutes of Health (NIH) Director's Transformative Research Award initiative is a component of the NIH Common Fund's High-Risk, High-Reward Research program, which supports exceptionally creative, highly innovative scientists and research with the potential for broad impact in biomedical or behavioral science. Starting in FY21, NIH piloted a 3-year anonymized review process of the Transformative Research Award applications to determine if an anonymized review process could be conducted and would meet the NIH merit review criteria. Additionally, NIH asked STPI to determine if an anonymized review process would change the demographic and institutional diversity of the applicant and awardee groups. STPI performed an annual review and prepared a comprehensive evaluative report. STPI found that, for the most part, anonymization and rigorous review were achieved. The results of STPI's evaluation will be used in policy decisions, ultimately made by the NIH Director, regarding the implementation of an anonymized review process for the Transformative Research Award initiative, as well as possible expansion to other initiatives and mechanisms.

U.S. Agency for International Development Energy Evidence and Learning Framework

The U.S. Agency for International Development (USAID) has a long history of successful programs in the energy sector all over the world, including promotion of renewable energy development, power sector planning and operations, strengthening policy and regulatory frameworks, and building the capacity of key institutions such as utilities and government agencies. The Energy Division supports this programming through thought leadership, tailored technical assistance to Missions in the design of programs, and the provision of technical expertise through centrally managed mechanisms that are available for Mission buy-in. In 2023, STPI staff drafted six monitoring guides to support approaches for USAID energy program stakeholders to manage adaptively programmatic portfolios in the areas of: (1) decarbonization, (2) energy access, (3) energy efficiency, (4) energy planning, (5) mobilization of finance, and (6) regional and cross border power trade. Each guide contained indicators that are specifically selected to reflect "outputs" (near-term observable signs of progress) and "outcomes" (longer-term changes in the world to which USAID's efforts have contributed, but are not necessarily a direct result of those activities), with examples demonstrating how those indicators might be operationalized. STPI staff also drafted two retrospective reviews of portfolios of USAID energy projects: (1) energy planning and (2) energy efficiency. These documents are intended to help USAID staff and external stakeholders understand the extent and impacts of USAID activities around energy efficiency and planning, and support program managers in designing and adaptively managing energy programs.

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