APPENDICES FOR THE IMPLEMENTATION OF FEDERAL PRIZE AND CITIZEN SCIENCE AUTHORITY: FISCAL YEARS 2021–2022

A Report by the

OFFICE OF SCIENCE AND TECHNOLOGY POLICY

In Response to the Requirements of the

America COMPETES Reauthorization Act of 2010 *and the*

Crowdsourcing and Citizen Science Act

April 2024

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 in 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.

About this Document

This document presents the eighth report on the use of prize competitions and challenges conducted by Federal agencies to spur innovation, engage citizen solvers, address tough problems, and advance their core missions. It also presents the third report on crowdsourcing and citizen science activities conducted by Federal agencies.

Copyright Information

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Abbreviations and Acronyms

AICA	American Innovation and Competitiveness Act
CCS	crowdsourcing and citizen science
CCS Act	Crowdsourcing and Citizen Science Act of 2017
COMPETES Act	America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act of 2010
DOD	Department of Defense
DOE	Department of Energy
EOP	Executive Office of the President
EPA	Environmental Protection Agency
FedCCS	Federal Crowdsourcing and Citizen Science Community of Practice
GSA	General Services Administration
ICR	Information Collection Request
NASA	National Aeronautics and Space Administration
OMB	Office of Management and Budget
OSTP	Office of Science and Technology Policy
PC&C	prize competition and challenge
PRA	Paperwork Reduction Act
STEM	science, technology, engineering, and math
U.S.	United States
USGS	United States Geological Survey

Executive Summary

The White House Office of Science and Technology Policy (OSTP) is pleased to issue the appendices to the report on *Implementation of Federal Prize and Citizen Science Authority: Fiscal Years 2021-2022*, providing supplemental details on the various prize competitions and challenges (PC&C) and crowdsourcing and citizen science (CCS) conducted by federal agencies during the fiscal years 2021 and 2022.

The America COMPETES Reauthorization Act of 2010 (COMPETES) amended Section 24 of the Stevenson-Wydler Technology Act of 1980 with a provision on prize competitions. This provision granted broad authority to all Federal agencies to conduct prize competitions and challenges to spur innovation by permitting Federal agencies incentives to involve the American public, leveraging fresh perspectives and novel approaches to solve problems collectively. Since then, Federal agencies have developed various resources to support the PC&C Community of Practice.

The American Innovation and Competitiveness Act (AICA) (Public Law 114-329), which became law in January 2017, included the Crowdsourcing and Citizen Science Act. The CCS Act gave Federal agencies broad authority to use crowdsourcing and citizen science to advance agency missions and facilitate broader public participation in the research and innovation process. The Federal CCS Community of Practice (FedCCS) works within and across Federal agencies to support Federal agencies in engaging the public directly and collaboratively as partners to enhance agencies' diverse missions.[1]

OSTP is legislatively required by Congress 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 authorities. This report includes a description of the PC&C and FedCCS communities, a compilation of activity summaries on Federal PC&C and CCS projects active during fiscal years 2021 and 2022, and the surveys administered to collect these data.

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[1] The 2015 OSTP Memo can be found at https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/holdren_citizen_science_memo_092915_0.pdf.

Summary of Agency Prizes and Challenges: Fiscal Years 2021–2022

Introduction to Prize Competition and Challenges (PC&Cs)

PC&Cs have been used by the Federal Government as a means of finding creative solutions to challenging problems for many years. Agencies such as the National Aeronautics and Space Administration (NASA),[2] the Department of Defense (DOD),[3] and the Department of Energy (DOE)[4] have long possessed authorities to directly administer PC&Cs and to use appropriated funds for prize purses. However, 2010 brought the power of PC&Cs to the entire Federal Government, beginning with a memorandum from the Office of Management and Budget (OMB) on the use of prize competitions in March 2010, followed by the enactment of the COMPETES Act of 2010.[5] COMPETES expanded the authority of Federal agencies to fund PC&Cs through appropriations, gift funds from private entities, and as part of public-private partnerships in addition to previously existing authorities. In January 2017, the American Innovation and Competitiveness Act (AICA)[6] was signed into law. Among other changes to the broad prize authority previously granted to Federal agencies under COMPETES, the AICA encouraged agencies to eliminate unnecessary administrative burden and encouraged them to partner more broadly with the private sector and other government entities on incentive prize competitions, which could further expand their scope and sophistication. Agencies use PC&Cs to tap into a knowledge base that exists outside of the Federal Government. Using PC&Cs, agencies can achieve a variety of goals, such as generating innovative ideas, developing or demonstrating technology, building or strengthening a community, and supporting outreach and information dissemination efforts. While PC&Cs are not the right tool for every problem, they can serve as a mechanism for spurring and sourcing innovation if and when they are aligned with a broader strategy and used systematically within an agency. Federal PC&Cs have catalyzed advances in areas such as autonomous transport and infectious disease forecasting, and stimulated research and investment in market sectors including solar energy and small business development.

Challenge and Prize Federal Community of Practice

All Federal agencies operating PC&Cs are supported and assisted by the General Services Administration (GSA). In 2010, GSA launched Challenge.Gov to provide a federal-wide shared platform and services to mature and scale the use of PC&Cs. In 2016, OSTP and Challenge.Gov crowdsourced the expertise of Federal prize practitioners to develop and launch an online Prize and Challenge Toolkit,[7] a comprehensive resource that provides a guide to planning and executing Federal PC&Cs.

The Challenge.Gov program hosts a variety of resources and tools developed and administered by GSA to assist Federal agencies in developing and executing successful PC&Cs:
- **Challenge.Gov Platform.** Since 2010, more than 2,000 prize PC&Cs have been hosted at no cost to Federal agencies on Challenge.Gov. This platform provides a single location that allows public solvers the opportunity to view and engage with open (and archived) federally sponsored

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[2] 42 U.S.C. § 20144
[3] 10 U.S.C. § 4065
[4] 42 U.S.C. § 16396
[5] Public Law 111-358 (Jan. 4, 2011)
[6] Public Law 114-329 (Jan. 6, 2017)

[7] More information about the Challenge.Gov toolkit can be found at https://www.challenge.gov/assets/document-library/Challenge-Gov-Federal-Agency-Toolkit.pdf .

PC&Cs. In October 2021, Challenge.Gov launched an updated and redesigned platform with a new set of dynamic features to facilitate public engagement and participation in Federal PC&Cs.

- **Resources for the Prizes and Challenges Community of Practice.** Working in close coordination with agency prize leads and prize practitioners across the Federal Government, Challenge.Gov develops trainings, holds office hours, and hosts interactive events to provide opportunities for knowledge sharing and experiential learning. In addition to the monthly newsletter, the program provides case studies and blogs, and continuously develops new toolkit content, templates, and resources for the Prizes and Challenges Federal Community of Practice—a network and active community of more than 700 current and prospective challenge managers in the Federal Government. The Challenge.Gov program actively collects and monitors data related to PC&Cs on the platform and shares its findings back to the community through infographics and Town Hall community gatherings. Monitoring the proliferation of State and local crowdsourcing initiatives, Challenge.Gov expanded the Community of Practice to State and local government prize practitioners in 2018, inviting exchange and opening avenues for partnership.

- **In-person Training for Federal Prize Practitioners.** The Challenge.Gov program has offered in-person and remote training (e.g., live-streams, recorded webinars) to more than 2,000 people across the Federal Government.[8]

- **Tools and Services for Contracting.** GSA maintains the Multiple Award Schedule, 541613, Professional Services – Marketing and Public Relations, that provides agencies the ability to procure deeper technical expertise and dedicated services for their prize competitions.[9] Contractors on the schedule offer agencies options for technical assistance, prize platforms, and access to communities of individual solvers and teams interested in entering PC&Cs. GSA continues to assist agencies in taking advantage of the available services and to inform private sector vendors and agencies about the schedule and its benefits.

As the use of PC&Cs by Federal departments, independent agencies, and agencies within departments has increased, they have become increasingly ambitious, complex, and visionary.[10] Today, the Challenge.Gov platform features PC&Cs on a diversity of topics that align with the full breadth of missions of the federal government. Tens of thousands of solvers and innovators have participated in PC&Cs on Challenge.Gov, with additional entrants joining the PC&Cs through other means. The Challenge.Gov program actively works to engage the public and support Federal agencies to connect with solvers ideally suited to contribute to their prize competition or challenge. In addition, several agencies have chosen to administer PC&Cs through third-party contractors and many have conducted prize competitions under authorities other than COMPETES.

Federal agencies have worked to expand their capacity and institutional abilities to conduct PC&Cs in a number of different ways. In addition to internal support, many Federal agencies have also developed

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[8] 2 More information about the Challenge and Prizes Federal Community of Practice can be found at https://digital.gov/communities/challenges-prizes/.

[9] More information about the multiple award schedule can be found at https://www.gsaelibrary.gsa.gov/ElibMain/home.dohttp:/www.gsaelibrary.%20gsa.gov/ElibMain/sinDetails.do?scheduleNumber=MAS&specialItemNumber=541613.

[10] Throughout this report, "Federal agencies" refers to Federal departments, independent agencies, and agencies within departments.

open innovation program offices and dedicated personnel to support the development and use of PC&Cs.

Appendix A.   Prizes and Challenges under the COMPETES Reauthorization Act of 2010

This Appendix provides agency-submitted summaries of prizes and challenges conducted in FY19 and FY20 under the prize authority provided in COMPETES. Please note that agency plans for the upcoming two fiscal years are notional and subject to the availability of funding.

A.1.   Department of Commerce (USDOC)

A.1.1. 2021 Agile Robotics for Industrial Automation Competition[11]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Agile Robotics for Industrial Automation Competition (ARIAC) Competition is designed to test the agility of industrial robot systems, with the goal of enabling industrial robots on the shop floors to be more productive, more autonomous, and to require less time from shop floor workers. In this context, agility is defined as: 1) Failure identification and recovery, where robot can detect failures in a manufacturing process and automatically recover from those failures, 2) Automated planning, to minimize (or eliminate) the up-front robot programming time when a new product is introduced, 3) Fixtureless environment, where robots can sense the environment and perform tasks on parts that are not in predefined locations, 4) Plug and play robots, where robots from different manufacturers can be swapped in an out without the need for reprogramming.

Advancement of Agency Mission: New and innovative techniques will be explored and evaluated to help advance US competitiveness.

Plan for Upcoming Two Fiscal Years: The ARIAC competition will be continued in in FY23 and FY24.

A.1.2. 2022 Agile Robotics for Industrial Automation Competition[12]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The ARIAC Competition is designed to test the agility of industrial robot systems, with the goal of enabling industrial robots on the shop floors to be more productive, more autonomous, and to require less time from shop floor workers. In this context, agility is defined as: - Failure identification and recovery, where robot can detect failures in a manufacturing process and automatically recover from those failures - Automated planning, to minimize (or eliminate) the up-front robot programming time when a new product is introduced - Fixtureless environment, where robots can sense the environment and perform tasks on parts that are not in predefined locations - Plug and play robots, where robots from different manufacturers can be swapped in an out without the need for reprogramming

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[11] The website for 2021 Agile Robotics for Industrial Automation Competition is accessible at www.nist.gov/ariac.
[12] There was no website provided for 2022 Agile Robotics for Industrial Automation Competition.

Advancement of Agency Mission: Evaluate unique solutions to realizing robot agility to allow US industry to be more competitive and productive when implementing robots in their factories

Plan for Upcoming Two Fiscal Years: We plan to run the same ARIAC Competition in FY23 and FY24.

A.1.3. A Project of the Fifth National Climate Assessment[13]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: NA

Advancement of Agency Mission: None reported

Plan for Upcoming Two Fiscal Years: Competition launched on October 11, 2022 and runs through January 27, 2023

A.1.4. Automated Streams Analysis for Public Safety (ASAPS) Prize Challenge: Contest 1[14]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Public safety organizations are inundated with live streaming data from a variety of sources. This live streaming data generally falls into two categories—some of this data is structured, while much of it is unstructured. Structured data that resides in a fixed field within a record or file, the kind typically found in spreadsheets or relational databases, is formatted in a way so that it can be readily queried. By contrast, unstructured data (e.g., video and audio) generally does not have a pre-defined data model or is not organized in a pre-defined manner and is therefore, not readily searchable. The lack of a defined data model prevents the data from being automatically interpreted and used by automated decision support applications without significant human intervention. The ASAPS Challenge focused on the development of algorithms to detect and analyze a variety of emergency events from unstructured public safety data in real time. The increasing magnitude of live data from a variety of sources presents both a challenge and opportunity to public safety in making life-critical decisions regarding response and coordination to emergencies. The ASAPS Challenge was an artificial intelligence (AI) challenge to detect, analyze, and alert public safety to emergencies from streaming data. ASAPS fostered groundbreaking multidisciplinary research and innovation in real-time emergency data analytics using a first-of-its-kind data set of unstructured data from video, audio, textual communications, social media, and sensors. PSCR awarded prizes to six teams who submitted innovative concepts that addressed information extraction across multimodal data streams to analyze data in real-time to generate actionable data reports about simulated and staged emergency events. One of the most important objectives of this challenge was to demonstrate how data can be used to enable decision support tools and capabilities for public safety.

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[13] There was no website provided for A Project of the Fifth National Climate Assessment.

[14] The website for Automated Streams Analysis for Public Safety (ASAPS) Prize Challenge: Contest 1 is accessible at https://www.challenge.gov/?challenge=asapscontest1.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST's Public Safety Communications Research Program (PSCR) drives innovation and advances public safety communication technologies through cutting-edge research and development (R&D). PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the- art technologies that consumers on commercial networks now expect. The ASAPS Challenge advances the agency's mission by driving innovation in real-time data analytics, thus, improving emergency alerts, situational awareness and decision support tools and capabilities for public safety organizations. In line with the PSCR mission, this prize competition seeks to demonstrate an end-to-end system for public safety organizations by collaborating with solvers across a wide variety of sectors and with unique expertise.

Plan for Upcoming Two Fiscal Years: NIST PSCR's current prize competition plan for the next two fiscal years is to continue fostering innovation in first responder communications technology but to specifically focus on uncrewed aircraft systems, data de-identification, user interfaces and user experience (related to virtual, reality, augmented reality, etc.), indoor three-dimensional tracking technology, and artificial intelligence for the internet of things.

A.1.5. CHARIoT Challenge - Advancing First Responder Communications[15]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The CHARIot Challenge was a four-Phase, dual track competition that offered up to $1.1 million in cash prizes, with a mission to design Augmented Reality (AR) that interfaces leveraging Internet of Things (IoT) based sensor streams for first responders. The CHARIoT Challenge, hosted by PSCR and its challenge partners, invited innovators to build AR interfaces or IoT data emulators by participating in a multi-phase contest. The Challenge simultaneously ran two multi-phase contests: Build Augmented Reality Interfaces for First Responder and Emulate Smart City Data for Disaster Scenarios. Police, Fire, and Emergency Medical Services crews cannot respond efficiently without proper situational awareness. Up to now, they've relied on eyewitness, radio, and traditional communications channels for information. Today, IoT devices, smart buildings, and smart cities also have the potential to provide tremendous amounts of information that remain largely inaccessible by first responders and incident command officers. Through the CHARIoT Challenge, the AR and IoT contestants demonstrated the possibility of standardizing disparate IoT data streams and integrated them into actionable AR solutions that together will help public safety communicate and respond more efficiently during four emergency scenarios: active shooter, flood, mass transit and wildfire. The contestants' final submissions were evaluated fall of 2021. PSCR and IoT finalists have open-sourced the emulated IoT challenge data to continue the research and development for advanced communication technology for public safety: https://github.com/usnistgov/IoTData_EmergencyScenarios.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance

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[15] The website for CHARIoT Challenge - Advancing First Responder Communications is accessible at https://www.challenge.gov/?challenge=chariot.

economic security and improve quality of life. NIST's Public Safety Communications Research Program (PSCR) drives innovation and advances public safety communication technologies through cutting-edge research and development (R&D). PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the- art technologies that consumers on commercial networks now expect. The CHARIoT Challenge advanced the agency's mission by enabling first responders to have access to IoT data and by presenting the information through interfaces designed specifically for first responders. Leveraging augmented reality, this challenge demonstrated how to convey actionable information to first responders without distractions or cognitive overload. These solutions can improve a first responder's situational awareness allowing them to more effectively plan and respond during emergency scenarios

Plan for Upcoming Two Fiscal Years: NIST PSCR's current prize competition plan for the next two fiscal years is to continue fostering innovation in first responder communications technology but to specifically focus on uncrewed aircraft systems, data de-identification, user interfaces and user experience (related to virtual, reality, augmented reality, etc.), indoor three-dimensional tracking technology, and artificial intelligence for the internet of things.

A.1.6. CommanDING Tech Challenge - Command Dashboard Integrating Next-Gen Technology Challenge for Public Safety[16]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The National Institute of Standards and Technology's Public Safety Communications Research (PSCR) Division is hosting the Command Dashboard Integrating Next-Gen Technology (CommanDING Tech) Challenge, a four-phase competition looking for the best next-generation incident command dashboards. Through improved user interfaces and user experience (UI/UX) and the ability to work with video, sensor, and map data in multi-story buildings, PSCR aims to improve the quality of incident command dashboards and, in turn, improve the effectiveness of emergency response. Contestants will bring new technology to the arena or improve their existing technology throughout the Challenge. The finalists will showcase their dashboards by completing a public safety emergency scenario in real time. Contestants' dashboards can use a variety of technologies for the Challenge, including but not limited to virtual reality (VR), augmented reality (AR), web-based, or hand-held devices (phone or tablet). All submissions must be able to integrate and respond to multiple data feeds and have a mobile, intuitive user interface that makes it more efficient and effective for public safety officers to respond to emergency situations.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST PSCR drives innovation and advances public safety communication technologies through cutting-edge research and development. PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the-art technologies that consumers on commercial networks now expect. The CommanDING Tech Challenge aims to enhance state-of-the-art incident

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[16] The website for CommanDING Tech Challenge - Command Dashboard Integrating Next-Gen Technology Challenge for Public S is accessible at https://www.challenge.gov/?challenge=commandingtech.

command dashboards through improvements to user interfaces, ability to access data, and cost to public safety.

Plan for Upcoming Two Fiscal Years: NIST PSCR's current prize competition plan for the next two fiscal years is to continue fostering innovation in first responder communications technology but to specifically focus on uncrewed aircraft systems, data de-identification, user interfaces and user experience (related to virtual, reality, augmented reality, etc.), indoor three-dimensional tracking technology, and artificial intelligence for the internet of things.

A.1.7. Differential Privacy Temporal Map Challenge[17]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Large data sets containing personally identifiable information (PII) are exceptionally valuable resources for research and policy analysis in a host of fields supporting America's public safety agencies such as emergency planning and epidemiology. Temporal map data— information that is geographically situated and may change over time—is of particular interest to the public safety community in applications such as optimizing response time and personnel placement, natural disaster response, epidemic tracking, demographic data and civic planning. Yet, the ability to track a person's location over a period of time presents particularly serious privacy concerns. The NIST, PSCR Differential Privacy Temporal Map Challenge ran from October 2020 through June 2021 awarding $129,000 in cash prizes. The goal of the challenge was to seek innovative algorithms to de-identify public safety-related data with a privacy guarantee. The challenge also sought novel methods of evaluating the quality of synthetic data. Participants competed in a series of coding sprints using differential privacy methods on temporal map data. The goal was to create a privacy-preserving dashboard map that shows changes across different map segments over time. The challenge was highly successful with more than 70 unique algorithms submissions across all three sprints of the challenge. Four of those algorithms have been open sourced (links in winners table below). Three solutions participated in the Development Contest, where teams were coached by NIST experts to improve the robustness and documentation of their code, creating easy-to-use implementations of sophisticated differential privacy algorithms.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. PSCR drives innovation and advances public safety communication technologies through cutting-edge research and development. PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the-art technologies that consumers on commercial networks now expect. The Differential Privacy Temporal Map Challenge aimed to advance the agency's mission by providing public safety data analysts with secure, provable methods for de-identifying datasets that include temporal and spatial characteristics. Once a dataset is securely de-identified, analysts may share that data with other researchers and other public safety agencies with the goal to improve public safety data analytics.

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[17] The website for Differential Privacy Temporal Map Challenge is accessible at https://www.challenge.gov/?challenge=differential-privacy-temporal-map-challenge.

Plan for Upcoming Two Fiscal Years: NIST PSCR's current prize competition plan for the next two fiscal years is to continue fostering innovation in first responder communications technology but to specifically focus on uncrewed aircraft systems, data de-identification, user interfaces and user experience (related to virtual, reality, augmented reality, etc.), indoor three-dimensional tracking technology, and artificial intelligence for the internet of things

A.1.8. Enhancing Computer Vision for Public Safety Challenge[18]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Public Safety Communications Research (PSCR) Division of NIST launched the Enhancing Computer Vision for Public Safety challenge to create a new line of computer vision research to assist with the development of life-saving tools for public safety. Public safety officers who rely on computer vision in the field are often limited by image quality issues such as dirt or grease on a camera lens, poor lighting or simply low-quality camera equipment. To help first responders, PSCR wanted to understand what "good quality" means to a computer vision algorithm. The prize challenge had three goals: (1) create training data, including images and videos depicting camera impairments that hinder computer vision algorithms; (2) measure failure rate and research the best methods to assess the likelihood that the computer vision algorithms can make reliable decisions; (3) open data to inspire new research. This challenge enabled a new line of research into metrics to complement computer vision. Referred to as no reference (NR) metrics for computer vision, these algorithms automatically identify quality problems that hinder computer vision algorithms. PSCR envisions using computer vision systems in combination with NR metrics to mitigate camera impairments. By making these computer vision systems smarter, emergency operations can become safer. PSCR invited contestants to submit a concept paper proposing a dataset focused on one type of camera impairment and outlining the best method to assess computer vision failure rates for those media. Winning concept papers were invited to compete in phase 2 where contestants implemented their experimental designs. Winners who open source their datasets to the Consumer Digital Video Library (CDVL), hosted by NTIA/ITS, were eligible for an additional $12,000 award. The total prize purse for this competition was $240,000.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. PSCR drives innovation and advances public safety communication technologies through cutting-edge research and development. PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the-art technologies that consumers on commercial networks now expect. The Enhancing Computer Vision for Public Safety Challenge advanced NIST's missions by spurring the development of computer vision algorithms to aid in further research in public safety-focused computer vision systems. This challenge also contributed to the NIST mission by expanding the research community and increasing public awareness of NIST's research in this public safety use case.

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[18] The website for Enhancing Computer Vision for Public Safety Challenge is accessible at https://www.challenge.gov/?challenge=enhancing-computer-vision-for-public-safety-challenge.

Plan for Upcoming Two Fiscal Years: NIST PSCR's current prize competition plan for the next two fiscal years is to continue fostering innovation in first responder communications technology but to specifically focus on uncrewed aircraft systems, data de-identification, user interfaces and user experience (related to virtual, reality, augmented reality, etc.), indoor three-dimensional tracking technology, and artificial intelligence for the internet of things.

A.1.9. First Responder Smart Tracking Challenge[19]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: As first responders scour a building during search and rescue, the ability for incident commanders to know exactly where they are provides immense safety benefits. Having accurate location data in a structure is vital to their safety, especially in life-and-death situations where every second counts. Understanding a responder's location in all three dimensions is invaluable to first responder coordination and safety. In this challenge, participants explore how 3D tracking technology can be used in high-stress, time-sensitive environments. Successful participants will produce a technology that can track first responders to <1-meter accuracy in three dimensions, with no pre-deployed infrastructure and in a variety of non-ideal environments. It is essential that the solutions developed and submitted in the final phase of the competition meet the diverse needs of first responders and are affordable. A total of up to $5.6 million in prizes and support funding will be distributed across all five phases to support participants as they purchase materials, form teams, and create partnerships to develop their innovation. Prize money grows as teams advance through each phase, and several winners will ultimately be selected in Phase 5 to receive the largest cash prizes. Significant attention will be spent to ensure participants with strong ideas, algorithms, or otherwise partial solutions have opportunities to collaborate and coalesce their ideas with other participants. To this end, teams need not be fully set until the end of Phase 3; fluidity across teams is encouraged in the early phases. Walk-on participants will be allowed in Phases 2 and 3. Participants who are not selected as winners through the first two phases are permitted to engage in future phases with continued chances to win funds.

Advancement of Agency Mission: NIST mission is to "promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life." This challenge is highly responsive to that mission in seeking to advance technologies to improve the ability of public safety to respond to emergency situations.

Plan for Upcoming Two Fiscal Years: NIST PSCR's current prize competition plan for the next two fiscal years is to continue fostering innovation in first responder communications technology but to specifically focus on uncrewed aircraft systems, data de-identification, user interfaces and user experience (related to virtual, reality, augmented reality, etc.), indoor three-dimensional tracking technology, and artificial intelligence for the internet of things.

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[19] The website for First Responder Smart Tracking Challenge is accessible at https://frstchallenge.com/.

A.1.10.   First Responder UAS Endurance Challenge[20]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: NIST's Public Safety Communications Research (PSCR) Division drives innovation and advances public safety communication technologies through cutting-edge research and development. PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the-art technologies that consumers on commercial networks now expect. NIST PSCR launched the First Responder UAS Endurance Challenge, a 4-stage challenge with prize awards up to $552,000, on April 1, 2020. The advancement of Unmanned Aircraft Systems (UAS) research achieved through this challenge aimed to help support the development and operation of UAS that are intended to host critical tools for public safety missions, such as wireless communications systems. In pursuit of this goal, PSCR investigated drones (i.e., UAS) as deployable systems to enable first responders with broadband connectivity services by increasing the UAS flight endurance and efficiency when carrying a payload. In a typical search-and-rescue scenario, teams of law enforcement, firefighters, and other emergency agencies may be dispatched to a location where broadband LTE communications are unavailable. To maintain communications amongst first responders on the ground, a drone carrying an LTE system could be deployed that would extend the communications coverage area beyond the immediate area. Currently, first responders are using drones to provide many different mission capabilities, but the drones' flight time is limited. The UAS payload capacity, energy source and flight time are linked through design trade-offs that can be optimized for efficiency and flexibility. This challenge was designed to keep a UAS and its payload airborne for the longest time possible to support first responders on the ground while they conduct their mission. The challenge ended 2021 when the final contestants competed in a virtual final event.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST PSCR drives innovation and advances public safety communications technologies through cutting-edge research and development. PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the-art technologies that consumers on commercial networks now expect. This challenge helped advance the agency's mission by crowdsourcing ingenuity for design tradeoffs to flight time and payload. Other intended uses for the results include collaborations and new partnerships; insights into new technologies and an array of new products; and influencing industry competitiveness while driving down UAS production costs.

Plan for Upcoming Two Fiscal Years: NIST PSCR's current prize competition plan for the next two fiscal years is to continue fostering innovation in first responder communications technology but to specifically focus on uncrewed aircraft systems, data de-identification, user interfaces and user experience (related to virtual, reality, augmented reality, etc.), indoor three-dimensional tracking technology, and artificial intelligence for the internet of things.

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[20]   The website for the First Responder UAS Endurance Challenge is accessible at https://www.challenge.gov/?challenge=first-responder-uas-endurance-challenge.

A.1.11.   First Responder UAS Indoor Challenge (UAS 4.0)[21]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The purpose of the First Responder UAS Indoor Challenge was to advance innovative UAS solutions to support First Responders who need to scout an indoor structure and provide information about its condition and situational awareness prior to entry. The goal for contestants was to design, build, and fly a cost-effective UAS that is easy to control, highly durable, and provide first responders with a high-quality video signal needed to detect human life and assess hazards in the environment. Improvements to UAS usability and 'flyability', along with more advanced autonomous sensors that operate with no GPS signal, will prove to help UAS operators or pilots save the lives of first responders and the community.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST PSCR drives innovation and advances public safety communications technologies through cutting-edge research and development. PSCR works directly with first responders and solver communities to address public safety's urgent need to access the same broadband communications and state-of-the-art technologies that consumers on commercial networks now expect. The challenge contestants will aim to demonstrate the various ways a UAS might be leveraged in a constrained indoor environment to improve first responder situational awareness relative to current first responder standards. The metrics and data collected from contestant solutions assist NIST with metrology for communications and UAS technologies.

Plan for Upcoming Two Fiscal Years: NIST PSCR's current prize competition plan for the next two fiscal years is to continue fostering innovation in first responder communications technology but to specifically focus on uncrewed aircraft systems, data de-identification, user interfaces and user experience (related to virtual, reality, augmented reality, etc.), indoor three-dimensional tracking technology, and artificial intelligence for the internet of things.

A.1.12.   First Responder UAS Triple Challenge 3.1: FastFind - UAS Search Optimized[22]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The purpose of the First Responder Unmanned Aircraft System (UAS) FastFind Challenge (UAS 3.1) was to advance UAS technologies by building and flying a UAS designed to support first responder search and rescue (SAR) operations. The goal was for contestants to design, build, and fly a complete UAS solution that helps a SAR team locate multiple missing persons in a thick forested area by improving image detection and enhancing navigation techniques to find people faster. Potential innovations included sensor technology to detect a person in an area with dense foliage;

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[21] The website for First Responder UAS Indoor Challenge (UAS 4.0) is accessible at https://www.challenge.gov/?challenge=uas4.

[22] The website for First Responder UAS Triple Challenge 3.1: FastFind - UAS Search Optimized is accessible at https://www.challenge.gov/?challenge=first-responder-uas-triple-challenge-fastfind.

creation of new algorithms to optimize aerial search patterns dynamically; and development of artificial intelligence to process images or video feeds and identify humans within the designated search area. First responders have suggested these improvements could result in a reduction of total search time relative to current first responder standards. Based on concept papers (Stage 1) and demonstration videos (Stage 2), the contestants who met the evaluation criteria and had an operational UAS were selected to participate in the final live competition (Stage 3), which took place at a forest near Mississippi State University in Starkville, MS. To simulate a real-life scenario at the final stage, the challenge implementer geolocated several individuals throughout the forest in order to test each contestants' image detection solution in various forest densities. Over the course of two days, contestants were given multiple search areas in which to test and demonstrate the efficacy of their solution. These tests sought answers to match the challenge's primary goal of evaluating technology that would improve speed and accuracy in identifying "lost" individuals.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST PSCR drives innovation and advances public safety communications technologies through cutting-edge research and development. PSCR works directly with first responders and solver communities to address public safety's urgent need to access the same broadband communications and state-of-the-art technologies that consumers on commercial networks now expect. The challenge contestants demonstrated various ways UAS might be leveraged to locate missing person target(s) quickly, accurately, and efficiently. These innovative solutions worked to reduce the total time and accuracy in identifying a person on the ground relative to current first responder standards. The metrics and data collected from contestant solutions will assist NIST in metrology for image detection and UAS technologies.

Plan for Upcoming Two Fiscal Years: NIST PSCR's current prize competition plan for the next two fiscal years is to continue fostering innovation in first responder communications technology but to specifically focus on uncrewed aircraft systems, data de-identification, user interfaces and user experience (related to virtual, reality, augmented reality, etc.), indoor three-dimensional tracking technology, and artificial intelligence for the internet of things.

A.1.13. First Responder UAS Triple Challenge 3.2: Lifelink - UAS Data Relay[23]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The purpose of the First Responder Unmanned Aircraft System (UAS) LifeLink Challenge (UAS 3.2) was to improve communications for first responder teams on the ground with a UAS carrying a network device in the airspace above the mission area. Contestants in this challenge were asked to design, build, and fly a complete UAS solution that provided first responders with continuous Internet Protocol (IP) connectivity while dispersed in a thick forested area with degraded cellular coverage and no available GPS (Global Positioning System) signal. Based on concept papers (Stage 1) and demonstration videos (Stage 2), the contestants who met the evaluation criteria and had an operational UAS were selected to participate in the final live competition (Stage 3), which was hosted at a forest near Mississippi State University in Starkville, MS. While the test area had cellular coverage,

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[23] The website for First Responder UAS Triple Challenge 3.2: Lifelink - UAS Data Relay is accessible at https://www.challenge.gov/?challenge=first-responder-uas-triple-challenge-lifelink.

the communications system on the UAS was tested as a standalone network that did not leverage existing cellular networks. The metrics collected at the live event included the maximum distance that a UAS carrying a network device could transmit a data signal to a User Equipment (UE) handset, the maximum throughput that the networking device could achieve to a single UE, and the maximum continuous data connection that the network device could maintain to multiple UE's distributed at different locations in an omni-directional pattern from the UAS. For each scenario, the UAS hovered at a fixed GPS coordinate location so that accurate horizontal distance measurements could be recorded, and then each contestant determined the ideal altitude at which their solution would operate. Each system was evaluated based on a combination of its performance during each of the three test scenarios in addition to learning the effects of directional antenna strength and network design.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST PSCR drives innovation and advances public safety communications technologies through cutting-edge research and development. PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the-art technologies that consumers on commercial networks now expect. The challenge contestants demonstrated various ways a UAS could support broadband communications so that first responders could continuously send and receive digital information while dispersed in a thick, forested area with no cellular connectivity. Contestants worked to innovate a cost-effective, robust, and easily deployable solution based on first responders' needs. The metrics and data collected from contestant solutions will assist NIST in metrology for communications and UAS technologies.

Plan for Upcoming Two Fiscal Years: NIST PSCR's current prize competition plan for the next two fiscal years is to continue fostering innovation in first responder communications technology but to specifically focus on uncrewed aircraft systems, data de-identification, user interfaces and user experience (related to virtual, reality, augmented reality, etc.), indoor three-dimensional tracking technology, and artificial intelligence for the internet of things.

A.1.14. First Responder UAS Triple Challenge 3.3: Shields Up! Securing UAS Navigation and Control[24]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The purpose of the First Responder Unmanned Aircraft System (UAS) Shields Up! Challenge (UAS 3.3) was to identify UAS cybersecurity threats and to build innovative countermeasures for those threats. Specifically, contestants were asked to frame their threats and countermeasures concerning the disruption and preservation of UAS navigation and control to prevent mission failure. Based on concept papers (Stage 1) and demonstration videos (Stage 2), the contestants who met the evaluation criteria and had an operational UAS were selected to participate in the final live competition (Stage 3), which took place remotely at the home location of each contestant with a challenge proctor and videographer. The final deliverable for each contestant was a live demonstration of the attack and countermeasure using web conferencing tools to show judges the final solution. The

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[24] The website for First Responder UAS Triple Challenge 3.3: Shields Up! Securing UAS Navigation and Control is accessible at https://www.challenge.gov/?challenge=first-responder-uas-triple-challenge-shieldsup.

contestants described their mission scenario, provided a technical summary of their solution, and demonstrated a successful attack and countermeasure of the UAS navigation and control software in the context of a real public safety mission. Each of the four finalists were able to demonstrate unique and novel attacks against their UAS, and each were able to showcase innovative solutions mitigating those attacks. All four solutions demonstrated vulnerabilities in UAS software design that may affect first responder missions and worthy of publicizing to public safety agencies.

Advancement of Agency Mission: NIST PSCR drives innovation and advances public safety (PS) communications technologies through cutting-edge research and development. PSCR works directly with first responders and the solver community to address PS's urgent need to access state-of-the-art technologies expected by consumers on commercial networks. The challenge contestants were asked to identify attacks that could be leveraged against UAS navigation and build innovative countermeasures for those attacks. The final deliverable for each contestant was a technical summary video of their submission depicting it in the context of a real PS mission so it could be used to educate PS about the risks involved with using UAS technology. The contest was successful in fulfilling these goals; each of the three finalists demonstrated unique and novel attacks and its mitigation, which will improve UAS cybersecurity for PS. The metrics and data collected from contestant solutions will assist NIST in metrology for security and UAS technologies.

Plan for Upcoming Two Fiscal Years: NIST PSCR's current prize competition plan for the next two fiscal years is to continue fostering innovation in first responder communications technology but to specifically focus on uncrewed aircraft systems, data de-identification, user interfaces and user experience (related to virtual, reality, augmented reality, etc.), indoor three-dimensional tracking technology, and artificial intelligence for the internet of things.

A.1.15.   Tech to Protect Challenge[25]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Tech to Protect Challenge was an ambitious five-phase open innovation opportunity led by the National Institute of Standards and Technology, Public Safety Communications Research (PSCR) Division. The challenge included five phases, events in ten different cities across the country, and ten contests allowing online and in-person participation. The first and second phases of the challenge resulted in early-stage software applications entered as solutions across ten discrete contests. These phases of the challenge included ten in-person Regional Code-a-thons. Approximately 50 public safety experts from local agencies and co-sponsors engaged with participants and PSCR researchers during these contests. The Online Contest, phase 3, resulted software applications with teams conditionally invited in January and based on their progress, later confirmed for the National Award Event in May 2020. The Demonstration and Seed Contests, phase 4, resulted in guests joining the National Award Event to view firsthand the progress made by participants. Each participant team completed a 12-minute demonstration presentation. The Judges awarded a cumulative $810,000 in prizes to contestants on May 1, 2020. The Progress Contest, phase 5, concluded in November 2020, and included 12 teams that progressed on their growth strategy. For the final awards, a cumulative $497,000 in prize was awarded to 9 teams on December 1, 2020. Overall, the challenge included over 20 co-

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[25] The website for Tech to Protect Challenge is accessible at https://www.challenge.gov/?challenge=tech-to-protect-challenge.

sponsors and supporting organizations from across the country. This was the first prize competition at NIST to award over $1 million in cash prizes. The successful participant-created solutions transitioned from research and development to scale-up, supporting emergency responders' use of advanced communications technologies in accomplishing their day-to-day activities and critical responsibilities in emergencies.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST's PSCR Division drives innovation and advances public safety communication technologies through cutting-edge research and development. The Tech to Protect Challenge advanced NIST and NIST's PSCR missions by engaging entrepreneurs, technologists, students, programmers, designers and public safety experts to create solutions across critical technical areas of public safety communications, including secure communications, location-based services, public safety data analytics, mission-critical voice and user interface/user experience (UI/UX). The participant solutions will support emergency responders' use of advanced communications technologies in accomplishing their day-to-day activities, critical responsibilities in emergencies, and support the continued development of tools and technology designed for and used by public safety.

Plan for Upcoming Two Fiscal Years: NIST PSCR's current prize competition plan for the next two fiscal years is to continue fostering innovation in first responder communications technology but to specifically focus on uncrewed aircraft systems, data de-identification, user interfaces and user experience (related to virtual, reality, augmented reality, etc.), indoor three-dimensional tracking technology, and artificial intelligence for the internet of things.

A.1.16.   The Mobile Fingerprinting Innovation Technology (mFIT) Challenge[26]

Sponsoring Agency and Office: National Institute of Standards and Technology

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Mobile Fingerprinting Innovation Technology Challenge (mFIT Challenge), hosted by PSCR and its challenge partners, asked innovators to advance mobile fingerprint capture technologies by building and demonstrating prototype applications to serve field law enforcement officers. In phase 1, six teams submitted award-winning concept papers. In the second of two phases, eight teams demonstrated that their mobile phone app successfully captured contactless fingerprint images using the device's available sensors. NIST awarded $349,500 over the two phases.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST's Public Safety Communications Research Program (PSCR) drives innovation and advances public safety communication technologies through cutting-edge research and development (R&D). PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the-art technologies that consumers on commercial networks now expect. The mFIT Challenge responded to requests from law enforcement agencies to improve field officers' ability to use fingerprints to verify the identity of individuals without carrying additional equipment.

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[26] The website for The Mobile Fingerprinting Innovation Technology (mFIT) Challenge is accessible at https://www.challenge.gov/?challenge=mfit-challenge.

Plan for Upcoming Two Fiscal Years: NIST PSCR's current prize competition plan for the next two fiscal years is to continue fostering innovation in first responder communications technology but to specifically focus on uncrewed aircraft systems, data de-identification, user interfaces and user experience (related to virtual, reality, augmented reality, etc.), indoor three-dimensional tracking technology, and artificial intelligence for the internet of things.

A.2. Department of Defense (DOD)

A.2.1. DARPA AI for Critical Mineral Assessment Competition[27]

Sponsoring Agency and Office: Defense Advanced Research Projects Agency

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: DARPA's Critical Mineral Assessments with AI Support (Critical MAAS) Competition solicited innovative solutions for automatically extracting and georeferencing features from scanned maps in support of the U.S. Geological Survey. The Energy Act of 2020 and the Bipartisan Infrastructure Law called for the USGS to accelerate assessments of the Nation's critical mineral resources, both still in the ground and in mine waste. These assessments inform timely decisions on land use, resource management, permitting, and international trade partnerships as the nation transitions to a low-carbon economy. Traditional assessment methods require significant time investment in digitizing historical paper maps. Our goal is to significantly speed up the assessment process by automating key steps. The competition included the following two independent challenges. First, the goal of the Map Georeferencing Challenge was to digitize and accurately geolocate a map of unknown location and coordinate system. The quality of features on scanned maps, critical for the identification of control points for alignment, can vary greatly. Second, the goal of the Map Feature Extraction Challenge was to identify all features on a map that appear in the map's legend. Automated map feature extraction is a difficult task because map features (polygons, points, lines, text) often overlap and are sometimes discontinuous. Not only do the features come in all shapes and sizes, but the same feature type can be depicted on different maps using different symbols or patterns. This makes it challenging to create a universal identifier for even a single feature such as a mine location or a mineral resource tract.

Advancement of Agency Mission: At the time of this survey, the results of the competition are still pending. However, the USGS is evaluating the solutions and plans to scale those solutions for operational use. These competitions will ultimately yield AI/ML tools that can be used for both general and specialized applications involving legacy documents and datasets.

Plan for Upcoming Two Fiscal Years: DARPA has launched the DARPA Triage Challenge.

A.2.2. NTIA/DoD 5G Challenge[28]

Sponsoring Agency and Office: Under Secretary of Defense Research and Engineering

Authority: America COMPETES Reauthorization Act of 2010

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[27] The website for DARPA AI for Critical Mineral Assessment Competition is accessible at https://criticalminerals.darpa.mil/.

[28] The website for NTIA/DoD 5G Challenge is accessible at https://www.challenge.gov/?challenge=5g-challenge-2022; https://5gchallenge.ntia.gov (formerly https://ntia.gov/5g-challenge).

Competition Summary: NTIA's Institute for Telecommunication Sciences (NTIA/ITS), in collaboration with DoD, hosted the 2022 5G Challenge to accelerate the adoption of open interfaces, interoperable components, and secure, modular, and multi-vendor solutions. The 2022 5G Challenge Preliminary Event: RAN Subsystem Interoperability comprised the first of two 5G Challenge competitions. In this first-year event, NTIA/ITS offered a $3,000,000 prize purse to contestants who successfully integrated and tested Open RAN radio units (O-RU), distributed units (O-DU), and/or central units (O-CU). In the Stage One White Paper Applications, participants applied by submitting a white paper, which required contestants to document 3GPP and O-RAN Alliance specification compliance and subsystem test reports. In the Stage Two Emulated Integration Testing, NTIA/ITS evaluated each contestant subsystem independently with a wrap-around emulator and test harness. We evaluated basic functionality and standards conformance. Each contestant whose subsystem(s) achieved a basic level of functional performance qualified for an Emulated Integration prize of $150,000. The contestant with the best Software Bill of Materials (SBOM) received a $200,000 prize. SBOMs facilitate improved security via vulnerability management by identifying dependencies, patch requirements, license requirements, and risk of cyberattack. SBOMs were evaluated for completeness, intelligibility, depth of dependencies listed, disclosure of known unknowns, and compliance to SBOM format standards. During the Stage Three Network Integration Testing, NTIA/ITS integrated multiple vendor subsystems into an end-to-end network. Working with five different vendors, we successfully integrated the following subsystems: user equipment, radio unit (RU), distributed unit (DU), central unit (CU), and Core. In true plug-and-play fashion, contestants approached network integration with no prior experience interoperating with their fellow contestants' subsystems.

Advancement of Agency Mission: NTIA/ITS, the US government's spectrum and communications lab, works to realize the full potential of telecommunications technology to drive a new era of innovation, development, and productivity. The Department of Defense (DoD) Office of the Undersecretary of Defense for Research and Engineering (OUSD(R&E)) serves as the primary advisor to DoD leadership on all matters pertaining to the Department's Research and Engineering (R&E) enterprise, technology development and transition, developmental prototyping, experimentation, and administration of testing ranges and activities. The 5G Challenge accelerated adoption of interoperable 5G Open RAN solutions to advance 5G interoperability towards true plug-and-play operation. An open, modular, and interoperable environment offers new vendor opportunities. A diversified marketplace delivers innovation and drives down costs. The 5G Challenge test-plans, educational videos, and lessons learned are being used by industry, academia, and government stakeholders, such as DoD's NextG to FutureG program. The objective, independent findings of the 2022 5G Challenge contributed scientific data on the true state of the 5G industry.

Plan for Upcoming Two Fiscal Years: NTIA/ITS plans to host a 2023 5G Challenge that builds upon the success of the 2022 5G Challenge Preliminary Event. This 2023 challenge will ask participants to integrate and test their 5G subsystems with other 5G participating subsystems, with the goal of accelerating the adoption of open interfaces, interoperable subsystems and modular, secure, and multi-vendor solutions. Participants will be asked to submit a combined Central Unit and Distributed Unit (CU/DU), a Radio Unit (RU) and/or a gNodeB. Applicants will first submit whitepapers describing their solutions, and a field of contestants will be invited to perform emulated testing with government-provided host lab facilities. The host lab will perform wraparound emulation testing on each contestant subsystem individually, and prizes will be awarded for successful emulation testing. Subsequently, contestants will be challenged to integrate with fellow contestants' subsystems and additional prizes will be awarded for this successful network integration.

A.2.3. xTechSearch 5[29]

Sponsoring Agency and Office: Army - Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASA(ALT))

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The xTechSearch competition is ASA(ALT)'s flagship competition that has been running since 2018. In February 2020, the U.S. Army launched the fifth iteration of xTechSearch, an open-topic competition providing opportunities for non-traditional small businesses across the U.S. to submit innovative technology solutions—as either a new application for an existing technology or an entirely new technology concept—that could have an impact to the U.S. Army. The xTechSearch program will also strive to integrate these small businesses into the Army's S&T ecosystem by providing research opportunities with Army labs, including authorized access to the Army's organic intellectual and technical capital. Every small business idea submitted receives detailed operational and technical feedback from Army stakeholders. Participating companies have access to training, mentorship and other support infrastructure as they progress through the contest to determine how best to align their technology solutions with real users and buyers within the Army. Finalists are entered into the xTech Accelerator to receive intensive mentorship and access to networking events to help grow their companies for Army and commercial users.

Advancement of Agency Mission: xTechSearch 5 was able to bring in new and innovative ideas to the Army and educate small businesses on how to further develop their technology solutions to support the Warfighter. The small businesses were able to participate in an accelerator program which allowed them to learn how to do business with the Army and create connections across the DOD for potential application use.

Plan for Upcoming Two Fiscal Years: In FY22, the agency plans to launch xTechSearch 6, in FY23 xTechSearch 7, in FY24 xTechSearch 8 providing additional opportunities for the final winners of the competitions to submit for a Phase I SBIR award.

A.3.   Department of Health and Human Services (HHS)

A.3.1. $100,000 Start a SUD Startup Challenge - 2022[30]

Sponsoring Agency and Office: National Institutes of Health - National Institute on Drug Abuse

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The National Institute on Drug Abuse (NIDA), one of the components of the National Institutes of Health (NIH), announces the annual "$100,000 Start an SUD Startup" Challenge. The Challenge goal is to support research ideas in the area of Substance Use Disorders (SUDs) that are intended to be the foundation for the development of successful new startups. NIDA expects that the Challenge will enable the winning teams to test the premise that their research idea can be fostered into a biotech startup, and that eventually, the newly created startups will contribute to the pool of

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[29]   The   website   for   xTechSearch   5   is   accessible   at
https://www.arl.army.mil/xtechsearch/competitions/xtechsearch-5.html.

[30] The website for $100,000 Start a SUD Startup Challenge - 2022 is accessible at
https://www.challenge.gov/?challenge=2022-100000-start-an-sud-startup-challenge.

innovative small business companies that can successfully compete for NIDA's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) funding. The Challenge is to be administered in two stages. Up to 12 winning teams will be offered a non-cash prize of a 6-month long product development mentorship from NIDA biomedical entrepreneurship experts in Stage 1. The teams that successfully complete the training process, culminating in each team's startup presentation, will be awarded up to $10,000 per team in Stage 2. The Challenge total purse is up to $100,000.

Advancement of Agency Mission: The general purpose of NIDA is to conduct and support biomedical and behavioral research, health-services research, research training, and health information dissemination with respect to the prevention of drug use and the treatment of substance use disorders. This Challenge is consistent with and advances the mission of NIDA as described in 42 U.S.C. 285o in that it supports biotech startups in the development of research ideas that would further an understanding and management of SUD.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.2. $100,000 for Start a SUD Startup - 2021[31]

Sponsoring Agency and Office: National Institutes of Health - National Institute on Drug Abuse

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The National Institute on Drug Abuse (NIDA), one of the components of the National Institutes of Health (NIH), announces the annual "$100,000 for Start a SUD Startup" Challenge. The Challenge goal is to support research ideas in the area of Substance Use Disorders (SUDs) that are intended to be the foundation for the development of successful new startups. NIDA expects that the Challenge will enable the winners to test the premise that their research idea can be fostered into a biotech startup, and that eventually the newly created startups will contribute to the pool of innovative small business companies that can successfully compete for NIDA's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) funding.

Advancement of Agency Mission: The general purpose of NIDA is to conduct and support biomedical and behavioral research, health-services research, research training, and health information dissemination with respect to the prevention of drug use and the treatment of drug addiction. This Challenge is consistent with and advances the mission of NIDA as described in 42 U.S.C. 285o in that it supports biotech startups in the development of research ideas that would further an understanding and management of substance use disorder (SUD).

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

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[31] The website for $100,000 for Start a SUD Startup - 2021 is accessible at https://www.challenge.gov/?challenge=2021-start-a-sud-startup-challenge.

A.3.3. 2022 Million Hearts ® Hypertension Control Champions Challenge[32]

Sponsoring Agency and Office: Centers for Disease Control and Prevention

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Heart disease and stroke are the 1st and 5th leading causes of death in the United States. Hypertension is a leading risk factor for heart disease and stroke and nearly half of adults in the US have hypertension, yet only 1 in 4 has blood pressure controlled. To address this health crisis, the Million Hearts Hypertension Control Challenge identifies clinicians, healthcare practices, and health systems that have prioritized hypertension control and have demonstrated exceptional achievements in controlling hypertension among at least 80% of their patients ages 18-85 years old with hypertension.

Advancement of Agency Mission: The Million Hearts initiative, co-led by CDC and the Centers for Medicare and Medicaid Services, has a goal of preventing 1 million heart attacks and strokes by 2022. To support this goal, the initiative has prioritized optimizing cardiovascular care, including increasing rates of hypertension control.

Plan for Upcoming Two Fiscal Years: CDC averages about 3 prize competitions every fiscal year. With our FY2021 interagency agreement with NASA's Center of Excellence for Collaborative Innovation (CoECI), we are able to more strongly support prize competitions. There are at least two prize competitions planned for FY2023 using this mechanism with more under development. In FY2022, we developed an internal site to provide resources about federal prize competitions, crowdsourcing, and citizen science to build capacity within the agency.

A.3.4. 2022 REACH Lark Award Challenge[33]

Sponsoring Agency and Office: Centers for Disease Control and Prevention

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Across the United States, some groups are often less healthy than others. Reasons for this include where people live, their access to places to be physically active or healthy foods, how much money or education they have, and how they are treated because of their racial or ethnic backgrounds. The Racial and Ethnic Approaches to Community Health (REACH) program is at the forefront of CDC's efforts to reduce health disparities. Since REACH was established in 1999, the program has demonstrated success in addressing health disparities and promoting health equity by engaging with diverse communities and implementing culturally tailored interventions. The REACH Lark Award Challenge recognizes extraordinary individuals, organizations, and community coalitions associated with the REACH program. The award recipient will have meaningfully assisted with and carried out culturally tailored interventions that advance health equity, reduce health disparities, and increase community engagement to address preventable health risks such as tobacco use, poor nutrition, physical inactivity, and inadequate access to clinical services. The award recipient works with populations that are disproportionately affected by chronic disease, including: African American/Black,

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[32] The website for 2022 Million Hearts Hypertension Control Champions Challenge is accessible at https://millionhearts.hhs.gov/partners-progress/champions/challenge.html.
[33] The website for 2022 REACH Lark Award Challenge is accessible at https://www.challenge.gov/?challenge=reach-lark-award-challenge-2022.

American Indian or Alaska Native, Asian, Hispanic or Latino, and Native Hawaiian or other Pacific Islander persons.

Advancement of Agency Mission: The Division of Nutrition, Physical Activity, and Obesity (DNPAO) within CDC's National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP) highlights the winners of the REACH Lark Award to partners and program recipients through focused communication and with the general public through a press release and information on the websites of CDC/NCCDPHP/DNPAO. This communication facilitates the dissemination of innovative, culturally tailored interventions that aim to reduce health disparities in chronic disease conditions. These efforts contribute to advancing CDC's mission to increase the nation's health security and supports CDC's vision of equitably protecting health, safety, and security. The prize also advances DNPAO's efforts to improve the overall health and well-being of all people, with a focus on promoting health equity among groups experiencing more risk factors for chronic diseases.

Plan for Upcoming Two Fiscal Years: CDC averages about 3 prize competitions every fiscal year. With our FY2021 interagency agreement with NASA's Center of Excellence for Collaborative Innovation (CoECI), we are able to more strongly support prize competitions. There are at least two prize competitions planned for FY2023 using this mechanism with more under development. In FY2022, we developed an internal site to provide resources about federal prize competitions, crowdsourcing, and citizen science to build capacity within the agency.

A.3.5. 3-D Retina Organoid Challenge (3-D ROC) Phase III[34]

Sponsoring Agency and Office: National Institutes of Health - National Eye Institute

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The NEI, part of the National Institutes of Health, launched the 3-D Retina Organoid Challenge (3-D ROC) three-phase challenge in 2017 to stimulate research using retina organoids. These organoids are similar to human retinas but are grown in a lab from stem cells, enabling researchers to study eye diseases and treatments noninvasively. In this Challenge, NEI sought 3-D human retina organoid prototypes that are physiologically relevant. Such model systems could be transformational for vision research and regenerative medicine. New models could be used for applications such as understanding eye development, studying retinal biology, modeling diseases, identifying and testing treatments, and serving as a tissue source to use in transplantation. In this Challenge, solution(s) should yield reproducible, retina organoid models that represent the complexity, structure, and function of the human retina and are amenable for use in either modeling diseases or high-content screening. With this Challenge, NEI aimed to: deliver a robust 3-D retina organoid system that the broader research community can leverage for their work, galvanize cross-discipline collaborations to encourage transformational advances that will result in meaningful therapies; eliminate limitations in current organoid protocols and accelerate development of 3-D retina organoids that faithfully model human tissue, and model retinal diseases and test treatments in a system directly relevant to humans.

Advancement of Agency Mission: The research group that won first place created a three-dimensional retinal model that recreates pathological features of age-related macular degeneration, with the ultimate goal of discovering new treatments for this blinding disease. The runner up team evaluated

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[34] The website for 3-D Retina Organoid Challenge (3-D ROC) Phase III is accessible at https://www.challenge.gov/?challenge=3d-roc-phase3.

the effects of drug toxicities on the retina and developed a first-of-its-kind organoid model of Alzheimer's disease retinopathy. Apart from the important scientific work that was achieved, there were many high impact publications that cited this Challenge. NEI deems that this Challenge was successful outside of status quo and has helped the agency to advance its mission by fostering collaborations, promoting innovation, and increasing public awareness.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.6. AHRQ Challenge on Innovative Solutions to Update or Re-Create TeamSTEPPS Videos[35]

Sponsoring Agency and Office: Agency for Healthcare Research and Quality

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Healthcare has evolved and advanced since the original TeamSTEPPS videos were created, and many of the current TeamSTEPPS videos no longer meet current healthcare setting needs. AHRQ plans to replace their content to capture the innovations and practices observed in the healthcare landscape today. This AHRQ Challenge seeks innovators to update the current TeamSTEPPS videos to provide improved TeamSTEPPS tools for communication and collaboration among healthcare team members.

Advancement of Agency Mission: The videos will enhance the TeamSTEPPS program to provide tools for improving communication and to emphasize patient engagement at the center of care.

Plan for Upcoming Two Fiscal Years: AHRQ plans additional challenge competitions including a challenge on integrating healthcare system data with systematic review findings, the impact of AHRQ's patient safety tools, and challenges to advance digital health.

A.3.7. ASPIRE Reduction-to-Practice Challenge[36]

Sponsoring Agency and Office: National Institutes of Health - National Center for Advancing Translational Sciences

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The National Center for Advancing Translational Sciences (NCATS) invited novel solutions for the Reduction-to-Practice Challenge for the NCATS A Specialized Platform for Innovative Research Exploration (ASPIRE) Program. The overall goal of the NCATS ASPIRE Challenges is to reward and spur innovative and catalytic approaches towards solving the opioid crisis through development of: (1) novel chemistries; (2) data-mining and analysis tools and technologies; and (3) biological assays that will revolutionize discovery, development and pre-clinical testing of next generation, safer and non-addictive analgesics to treat pain, as well as new treatments for opioid use disorder (OUD) and overdose. For the first phase of this challenge, innovators submitted designs, not final products or

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[35] The website for AHRQ Challenge on Innovative Solutions to Update or Re-Create TeamSTEPPS Videos is accessible at https://www.ahrq.gov/challenges/past/teamstepps-video/index.html.

[36] The website for ASPIRE Reduction-to-Practice Challenge is accessible at https://www.challenge.gov/?challenge=aspire-2020; https://ncats.nih.gov/aspire/funding/2020Challenge.

prototypes. The goal for the second phase – the follow-up Reduction-to-Practice Challenge – was for an open competition to integrate the best designs for a chemistry database, electronic laboratory knowledge portal for synthetic chemistry, algorithms, and biological assays into a single comprehensive platform. Innovators should invoke further scientific and technological development of a comprehensive and integrated solution for the development of new treatments for pain, opioid use disorder and overdose. Innovators design and then demonstrate their integrated solutions and working prototypes, from which winners were selected.

Advancement of Agency Mission: The main mission of NCATS is to coordinate and develop resources that leverage basic research in support of translational science and to develop partnerships and work cooperatively to foster synergy in ways that do not create duplication, redundancy, and competition with industry activities (42 USC 287(a)). In order to fulfill its mission, the NCATS supports projects that will transform the translational process so that new treatments and cures for diseases can be delivered to patients faster by understanding the translational process in order to create a basis for more science-driven, predictive and effective intervention development for the prevention and treatment of all diseases. In line with these authorities, this Challenge will lead to innovative prototypes for developing technology to revolutionize discovery, development and pre-clinical testing of new and safer treatments of pain, OUD, and overdose; the result will be generalizable tools that will be widely available to fill longstanding gaps that have impeded the marriage of basic and translational sciences, especially in the field of automated and synthetic chemistry.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.8. KidneyX Artificial Kidney Prize Phase 2[37]

Sponsoring Agency and Office: HHS Office of the Assistant Secretary for Health (OASH)

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: This Competition solicits applications that support innovations in regenerative medicine, cellular engineering, tissue engineering, systems biology, and synthetic biology to either advance the development of a bioartificial kidney prototype or create enabling tools that address key challenges for developing an artificial kidney platform. With the Artificial Kidney Prize, HHS and American Society of Nephrology (ASN) intend to stimulate the market for further kidney health innovation, drawing greater participation and capital.

Advancement of Agency Mission: As part of the Advancing American Kidney Health Initiative, KidneyX launched the Artificial Kidney Prize, a competition to accelerate artificial kidney development toward human clinical trials. This multiphase competition is KidneyX's first fully dedicated effort toward artificial kidney advancement and the Artificial Kidney Prize Phase 2 has a $9.2 million prize purse.

Plan for Upcoming Two Fiscal Years: N/A

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[37] The website for Artificial Kidney Prize Phase 2 is accessible at https://www.kidneyx.org/PrizeCompetitions/akp2 https://www.challenge.gov/?challenge=artificial-kidney-prize-phase-2&tab=overview.

A.3.9. BRAIN Initiative Challenge: Considering Ethics During Brain Technology Development[38]

Sponsoring Agency and Office: National Institutes of Health - National Institute of Neurological Disorders and Stroke

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Science seeks to answer questions about ourselves and the world around us. Many times, the most important discoveries are completely unexpected – like when a moldy dish left out during vacation leads to the discovery of a vital medicine, penicillin! But, if something is unexpected, how can we prepare for positive and/or negative outcomes? When it comes to understanding the brain, enter: Neuroethics! Careful scientists must consider ethics during their research, including preparing for unanticipated consequences of exciting scientific advances. At the NIH, the Brain Research through Advancing Innovative Neurotechnologies® (BRAIN) Initiative is funding researchers to revolutionize our understanding of the human brain, including the development of devices to study the human brain and to treat brain disorders. While these devices are opening the doors to new discoveries, they also raise potentially new ethical questions. This challenge is seeking creative essays or videos from currently enrolled U.S. high school students that describe a teen's perspective on the ethics, limitations, and implications of emerging technology to study and treat disorders of the human brain.

Advancement of Agency Mission: This Challenge advanced the mission of the National Institute of Neurological Disorders and Stroke, and collaboratively with the partnering ICs, by gaining the youth's perspective on neuroethics. NINDS gained an increased understanding of the public's perspective of neurotechnology and neuroethics, as well as enhanced engagement with students for scientific workforce development.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.10. BRAIN Initiative Challenge: Ethical Considerations of Brain Technologies[39]

Sponsoring Agency and Office: National Institutes of Health - National Institute of Neurological Disorders and Stroke

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: What would happen if humans could altogether stop the effects of aging on the brain? What if we could precisely map, record, and simulate the neural activity of memories? What if we could enhance brain function and intelligence? While these questions seem to lie in the realm of science fiction, we may one day have to address them - and their impacts on society. The line between science fiction and reality is constantly being redrawn as research discoveries drive the advancement and state of modern technology. We use technologies every day that collect and store massive amounts of

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[38] The website for BRAIN Initiative Challenge: Considering Ethics During Brain Technology Development is accessible at https://www.challenge.gov/?challenge=brain-initiative-challenge.

[39] The website for BRAIN Initiative Challenge: Ethical Considerations of Brain Technologies is accessible at https://www.challenge.gov/?challenge=brain-initiative-2022.

personal, biological data – think of wristband fitness trackers. In the 21st century, we are faced with a variety of questions and challenges related to understanding the brain, as well as the treatment and prevention of brain diseases. Answering questions with science and technology can often lead to unexpected discoveries that also raise ethical considerations. This challenge seeks creative essays and videos from currently enrolled U.S. high school students from all backgrounds envisioning current and/or near-future states of brain technologies and the ethical dilemmas they may bring. How do these real or hypothetical dilemmas relate to and/or inform the use of emerging technologies for studying and/or treating disorders of the human brain?

Advancement of Agency Mission: The mission of the National Institute of Neurological Disorders and Stroke is to seek fundamental knowledge about the brain and nervous system and to use that knowledge to reduce the burden of neurological disease. This Challenge will advance this mission by providing opportunities for engagement in brain science and research through soliciting youth perspectives on neuroethics and neurotechnology.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.11.   Big Data Analysis Challenge: Creating New Paradigms for Heart Failure Research[40]

Sponsoring Agency and Office: National Institutes of Health - National Heart, Lung, and Blood Institute

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The National Heart, Lung, and Blood Institute (NHLBI), part of the National Institutes of Health (NIH), invited novel Solutions for the NHLBI Big Data Analysis Challenge: Creating New Paradigms for Heart Failure Research. The goal of the challenge was to foster innovation in computational analysis and machine learning approaches utilizing large-scale NHLBI-funded datasets to identify new paradigms in heart failure research. The challenge aimed to address the need for new open source disease models that can define sub-phenotypes of heart failure to serve as a springboard for new research hypotheses and tool development in areas of heart failure research from basic to clinical settings.

Advancement of Agency Mission: The mission of the NHLBI is to promote the prevention and treatment of heart, lung, and blood diseases and enhance the health of all individuals so that they can live longer and more fulfilling lives. In order to fulfill its mission, the NHLBI stimulates basic discoveries about the causes of disease, enables the translation of basic discoveries into clinical practice, fosters training and mentoring of emerging scientists and physicians, and communicates research advances to the public. The NHLBI Strategic Vision specifically encompasses an objective to leverage emerging opportunities in data science to open new frontiers in heart, lung, blood, and sleep research. This Challenge will lead to innovation in disease research paradigms to revolutionize basic discovery, translational research, and/or clinical investigations in adult heart failure; the result will be generalizable models of adult heart failure that will be widely available to fill longstanding gaps in our understanding and treatment of this disease.

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[40] The website for Big Data Analysis Challenge: Creating New Paradigms for Heart Failure Research is accessible at https://www.nhlbi.nih.gov/grants-and-training/funding-opportunities-and-contacts/NHLBI-heart-failure-data-challenge ; https://www.challenge.gov/?challenge=heart-failure-big-data-analysis-challenge.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.12.   COVID-19 At Anywhere Diagnostics Design-a-Thon[41]

Sponsoring Agency and Office: Health and Human Services: Office of the Secretary

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The COVID-19 At-Anywhere Diagnostics Design-a-thon is jointly led by the HHS Office of the Chief Information Officer (OCIO), HHS Office of the Assistant Secretary for Health (OASH), and the U.S. Food and Drug Administration (FDA). This event is part of a series of events and is one way that HHS is working to advance diagnostic data interoperability, data reporting, and diagnostics innovation in partnership with stakeholders. Our goal is to work together to improve the diagnostic devices available to patients, streamline and alleviate reporting burdens, and ensure that design principles are open and transparent. We believe the public and private sectors should collaborate to effectively address this problem to improve the COVID-19 response.

Advancement of Agency Mission: COVID-19 Test Reporting can inform the design and implementation approaches for data element capture, harmonization, and reporting.

Plan for Upcoming Two Fiscal Years: N/A

A.3.13.   COVID-19 At Anywhere Diagnostics TOPx sprint[42]

Sponsoring Agency and Office: Health and Human Services: Office of the Secretary

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The U.S. Department of Health and Human Services (HHS) launched the "COVID-19 TOPx" technology sprint to continue momentum and further develop digital health tools to capture, harmonize, and securely transmit key data elements from at-anywhere COVID-19 diagnostic tests. Our COVID-19 TOPx sprint is building upon years of experience from the U.S. Census Bureau's "The Opportunity Project (TOP) Technology Sprints", including the HHS "TOP Health" Technology Sprint in 2018 and 2019 with Presidential Innovation Fellows. Both TOP and TOPx provide a process for government, industry, academia, and non-profit organizations to collaborate and create value from federal data. This fast-paced, 10-week COVID-19 TOPx Tech Sprint is the first time that HHS is using the recently published "TOPx Toolkit" by the U.S. Census Bureau. The TOPx toolkit includes step-by-step methods, checklists, templates, and best practices for open data sprints to help agencies accomplish a variety of goals including: address mission-critical priorities with data and technology innovation; recruit cross-sector participants; and facilitate a virtual technology development sprint on a flexible and modifiable timeline. This event series is a public-facing, open innovation technology sprint with industry and all sectors. During this sprint, innovative problem solvers will develop device-integrated software and digital health tools for automatic data capture and wireless transmission directly from at-anywhere COVID-19 diagnostic tests. Learn more about how the COVID-19 TOPx Tech Sprint launched

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[41] The website for COVID-19 At Anywhere Diagnostics Design-a-Thon is accessible at https://waters.crowdicity.com/hubbub/communitypage/22469.

[42] The website for COVID-19 At Anywhere Diagnostics TOPx sprint is accessible at waters.crowdicity.com.

by reading our blog post on HealthData.gov. The winning teams from the COVID-19 Diagnostics At-Anywhere Design-a-thon participated in the COVID-19 TOPx tech sprint and were highlighted in a HHS press release.

Advancement of Agency Mission: HHS launched the "COVID-19 TOPx" tech sprint with the U.S. Census Bureau to leverage The Opportunity Project (TOP) sprint model. The TOP model combines human-centered design techniques with agile technology sprints to encourage industry to rapidly create digital tools and add value from open government data. The participating tech teams retain ownership of all intellectual property rights to the products developed during the COVID-19 TOPx tech sprint. The long-term sustainability and continued product development and deployment is fully in their control.

Plan for Upcoming Two Fiscal Years: n/a

A.3.14. Cause of Death Elucidated (CODE) in Drug Overdose Challenge[43]

Sponsoring Agency and Office: National Institutes of Health - National Institute on Drug Abuse

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The National Institute on Drug Abuse (NIDA), one of the components of the National Institutes of Health (NIH), is launching the "Cause of Death Elucidated (CODE) in Drug Overdose" Challenge, which is soliciting ideas for novel postmortem toxicology screening tools that would be used to inform and streamline suspected drug overdose death investigations and to improve drug specification in overdose death counts. It is not expected or required that solvers currently have working prototypes. Solvers with prototypes at any stage of development or with prototypes that may be pivoted to postmortem toxicology screening are encouraged to submit their ideas to the Challenge. Ideas submitted to the Challenge must have a strong and rigorous scientific basis and should demonstrate that the proposed solution will be technically feasible with further support for development. To complement NIDA's efforts with this Challenge, NIDA also intends to announce separate funding opportunities, available to all interested parties and subject to applicable competitive processes, to support research and development efforts in this area.

Advancement of Agency Mission: The general purpose of NIDA is to conduct and support biomedical and behavioral research, health-services research, research training, and health-information dissemination with respect to the prevention of drug use and the treatment of drug addiction. This Challenge will improve the surveillance of drugs involved in overdose deaths and thus aligns with the NIDA mission to advance science on the consequences of drug use and addiction and to apply that knowledge to improve public health.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

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[43] The website for Cause of Death Elucidated (CODE) in Drug Overdose Challenge is accessible at https://www.challenge.gov/?challenge=cause-of-death-elucidated-(code)-in-drug-overdose.

A.3.15. Connecting the Community for Maternal Health Challenge[44]

Sponsoring Agency and Office: National Institutes of Health - Eunice Kennedy Shriver National Institute of Child Health and Human Development

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: As part of the National Institutes of Health (NIH) Implementing a Maternal health and PRegnancy Outcomes Vision for Everyone initiative (IMPROVE initiative), the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) is sponsoring this Connecting the Community for Maternal Health Challenge to encourage and reward non-profit community-based or advocacy organizations to develop research capabilities and infrastructure to pursue research projects in the area of maternal health, inclusive of maternal morbidity and mortality. (Maternal health refers to the health of women during pregnancy, childbirth, and the postnatal period. Maternal morbidity describes any short- or long-term health problems that result from being pregnant and giving birth. Maternal mortality refers to the death of a woman from complications of pregnancy or childbirth that occur during the pregnancy or within 6 weeks after the pregnancy ends.) By incentivizing the development of research capabilities, infrastructure, and experience, this challenge will empower registered 501(c)(3) (non-profit) organizations in the United States (such as advocacy, local community, faith-based, and other similar groups) to acquire skills and abilities in their organizations and more effectively become partners in and contribute to future NIH-funded maternal health research activities in areas that specifically impact their communities. The Challenge is offering a total prize purse of $3,038,000 which will be distributed across multiple phases of the competition and awarded to organizations who successfully complete the objectives and requirements of each phase. In addition to cash prizes, participating organizations will receive non-monetary incentives such as training and mentoring in writing research proposals and assistance in building the needed infrastructure required for research activities.

Advancement of Agency Mission: Founded in 1962, the general purpose of NICHD is the conduct and support of research, training, health information dissemination, and other programs with respect to gynecologic health, maternal health, child health, intellectual disabilities, human growth and development, including prenatal development, population research, and special health problems and requirements of mothers and children [42 U.S.C. § 285g]. The Institute's mission includes improving reproductive health, enhancing the lives of children and adolescents, and optimizing abilities for all, and its vision is "Healthy pregnancies. Healthy children. Healthy and optimal lives." This challenge aligns with NICHD's statutory authority and promotes its mission and vision by enabling the community to more actively pursue research that will help ensure every person has a healthy pregnancy and improve overall maternal health outcomes. This challenge creates value during and after the competition by encouraging organizations to develop new research capabilities that may have beneficial effects during and after the competition. NICHD and its partners are conducting this Challenge as part of the NIH IMPROVE Initiative which supports research focused on reducing preventable causes of maternal deaths and improving health for women before, during, and after delivery.

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[44] The website for Connecting the Community for Maternal Health Challenge is accessible at https://www.challenge.gov/?challenge=community-maternal-health.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.16.   DataWorks! Prize[45]

Sponsoring Agency and Office: National Institutes of Health - Office of the Director - Office of Data Science Strategy

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Federation of American Societies for Experimental Biology (FASEB) and National Institutes of Health (NIH) are championing a bold vision of data sharing and reuse. The DataWorks! Prize fuels this vision with an annual challenge that showcases the benefits of research data management while recognizing and rewarding teams whose research demonstrates the power of data sharing or reuse practices to advance scientific discovery and human health. We are seeking new and innovative approaches to data sharing and reuse in the fields of biological and biomedical research. To incentivize effective practices and increase community engagement around data sharing and reuse, the 2022 DataWorks! Prize will distribute up to 12 monetary team awards, in two categories: data sharing and data reuse. Submissions will undergo a two-stage review process, with final awards selected by a judging panel of NIH officials. The NIH will recognize winning teams with a cash prize, and winners will share their stories in a DataWorks! Prize symposium.

Advancement of Agency Mission: The complexity and volume of basic, translational, and clinical research data generated by NIH-supported investigators continues to rapidly increase. To fully utilize these data, NIH must develop a strategy to coordinate the collection, storage, analysis, use, and sharing of these data to ensure they are discoverable, interoperable, and reusable according to FAIR (Findable, Accessible, Interoperable, and Reusable) practices. One of the primary missions of ODSS is to catalyze and provide leadership, strategic guidance, and coordination for trans-NIH FAIR data activities. The DataWorks! Prize will advance this mission by establishing a partnership with the research community to broadly encourage and reward the adoption of FAIR data principles and other best practices that will ultimately enable better sharing, discovery, and secondary use of NIH-funded data.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.17.   Decoding Maternal Morbidity Data Challenge[46]

Sponsoring Agency and Office: National Institutes of Health - Eunice Kennedy Shriver National Institute of Child Health and Human Development

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD), part of the National Institutes of Health (NIH), announces its Decoding Maternal

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[45] The website for DataWorks! Prize is accessible at https://www.challenge.gov/?challenge=dataworks-prize.
[46] The website for Decoding Maternal Morbidity Data Challenge is accessible at https://www.challenge.gov/?challenge=decoding-maternal-morbidity-data-challenge.

Morbidity Data Challenge to help advance research on maternal health and promote healthy pregnancies. The Challenge goal is to devise new ways of analyzing the large dataset from its Nulliparous Pregnancy Outcomes Study: Monitoring Mothers-to-be (nuMoM2b) to identify factors that impact maternal morbidity (MM) and severe maternal morbidity (SMM) so that clinicians can more quickly and accurately identify and treat pregnancy-related conditions and prevent severe illness or death for a pregnant person. Through the Decoding Maternal Morbidity Data Challenge, NICHD seeks innovative approaches to identify new areas of research on SMM and MM from the nuMoM2b dataset. NICHD invites scientists and teams of scientists to use novel computational analysis, data mining, or unique learning approaches on the data to identify factors that impact SMM and MM so that clinicians can more quickly and accurately diagnose and treat pregnancy-related conditions and prevent severe illness and death among pregnant people.

Advancement of Agency Mission: The mission of NICHD is to lead research and training to understand human development, improve reproductive health, enhance the lives of children and adolescents, and optimize abilities for all. This Challenge will advance NICHD's mission by identifying new areas of research on maternal morbidity and severe maternal morbidity.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.18.   Design by Biomedical Undergraduate Teams (DEBUT) 2021[47]

Sponsoring Agency and Office: National Institutes of Health - National Institute of Biomedical Imaging and Bioengineering

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The NIBIB DEBUT Challenge solicits design projects that develop innovative solutions to unmet health and clinical problems. Areas of interest for the biomedical engineering projects include, but are not limited to: diagnostics, therapeutics, technologies for underserved populations or low-resource settings, point-of-care systems, precision medicine, preventive medicine, technologies to aid individuals with disabilities, and HIV/AIDS prevention and care. In addition to prizes where there is no restriction on the healthcare technology being developed, three categorical prizes will be awarded on: 1) HIV/AIDS prevention and care, 2) healthcare technologies for underrepresented populations and/or for low-resource settings, and 3) technologies for cancer prevention, diagnosis or treatment, with funds from the NIH Office of AIDS Research (OAR), the National Institute on Minority Health and Health Disparities (NIMHD), and National Cancer Institute (NCI), respectively. Student Teams participating in capstone design projects are especially encouraged to enter the Challenge.

Advancement of Agency Mission: The general purpose of NIBIB is the conduct and support of research, training, the dissemination of health information, and other programs with respect to biomedical imaging, biomedical engineering, and associated technologies and modalities with biomedical applications. In line with these authorities, by challenging undergraduate students to identify unmet clinical needs and develop innovative solutions for them, NIBIB targets the education of biomedical engineers who have the background, skills, and confidence to make outstanding contributions to biomedical technologies. Engaging undergraduate students to work in teams to design, build and

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[47] The website for Design by Biomedical Undergraduate Teams (DEBUT) 2021 is accessible at https://www.nibib.nih.gov/research-programs/DEBUT-challenge/DEBUT-2021-announcement.

debug solutions to real-world problems/needs in healthcare not only prepares them to function effectively in their future work environment, but also yields novel, innovative biomedical tools that can transform healthcare.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.19.   Design by Biomedical Undergraduate Teams (DEBUT) 2022[48]

Sponsoring Agency and Office: National Institutes of Health - National Institute of Biomedical Imaging and Bioengineering

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The NIBIB DEBUT Challenge solicits design projects that develop innovative solutions to unmet health and clinical problems. Areas of interest for the biomedical engineering projects include, but are not limited to: diagnostics, therapeutics, technologies for underserved populations or low-resource settings, point-of-care systems, precision medicine, preventive medicine, assistive and rehabilitative technologies to aid individuals with disabilities, and HIV/AIDS prevention and care. In addition to prizes where there is no restriction on the healthcare technology being developed, four categorical prizes will be awarded for: 1) HIV/AIDS prevention and care, with funds from the NIH Office of AIDS Research (OAR), 2) healthcare technologies for underrepresented populations and/or for low-resource settings, with funds from the National Institute on Minority Health and Health Disparities (NIMHD), 3) technologies for cancer prevention, diagnosis or treatment, with funds the National Cancer Institute (NCI), and 4) rehabilitative and assistive technologies for the functional and healthcare needs of people with disabilities, with funds from the National Center for Medical Rehabilitation (NCMRR) at the Eunice Kennedy National Institute of Child Health and Human Development (NICHD). Student Teams participating in capstone design projects are especially encouraged to enter the Challenge.

Advancement of Agency Mission: The general purpose of NIBIB is the conduct and support of research, training, the dissemination of health information, and other programs with respect to biomedical imaging, biomedical engineering, and associated technologies and modalities with biomedical applications. In line with these authorities, by challenging undergraduate students to identify unmet clinical needs and develop innovative solutions for them, NIBIB targets the education of biomedical engineers who have the background, skills, and confidence to make outstanding contributions to biomedical technologies. Engaging undergraduate students to work in teams to design, build and debug solutions to real-world problems/needs in healthcare not only prepares them to function effectively in their future work environment, but also yields novel, innovative biomedical tools that can transform healthcare.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

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[48] The website for Design by Biomedical Undergraduate Teams (DEBUT) 2022 is accessible at https://www.challenge.gov/?challenge=debut.

A.3.20. Envisioning Health Equity Art Challenge 2020[49]

Sponsoring Agency and Office: National Institutes of Health - National Institute on Minority Health and Health Disparities

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: As part of the 10-year anniversary of the National Institute on Minority Health and Health Disparities (NIMHD) at the National Institutes of Health (NIH), the Institute is launching the Envisioning Health Equity Art Challenge. The challenge will raise national awareness about the prevalence and impact of health disparities and inspire further research on minority health and health disparities. In the United States, Blacks/African Americans, Hispanics/Latinos, American Indians/Alaska Natives, Asian Americans, Native Hawaiians and other Pacific Islanders, socioeconomically disadvantaged populations, underserved rural populations, and sexual and gender minorities (described collectively as "health disparity populations") suffer higher rates of morbidity and mortality. The goal of the art challenge is to envision and express through art an America in which all populations have an equal opportunity to live long, healthy, and productive lives.

Advancement of Agency Mission: NIMHD, established as an Institute in 2010 (P.L. 111-148), leads scientific research to improve minority health and eliminate health disparities by conducting and supporting research; planning, reviewing, coordinating, and evaluating all minority health and health disparities research at NIH; promoting and supporting the training of a diverse research workforce; translating and disseminating research information; and fostering collaborations and partnerships. This Challenge will lead to increased national focus on research to reduce health disparities and promote health equity.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.21. Eye on the Future Video Contest Challenge[50]

Sponsoring Agency and Office: National Institutes of Health - National Eye Institute

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Science seeks to answer questions about ourselves and the world around us. Many times, the most important discoveries are completely unexpected – like when a moldy dish left out during vacation leads to the discovery of a vital medicine, penicillin! Science is all around us, and we are constantly learning from the natural world. This challenge is seeking original videos from currently enrolled U.S. high school students that describe a teen's perspective on why science is relevant to their lives and to the future. The goal of this video contest is to highlight teen interest and increase diversity in science. This contest will be open to teens nationally, with an emphasis on outreach to underrepresented groups in science.

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[49] The website for Envisioning Health Equity Art Challenge 2020 is accessible at https://www.challenge.gov/?challenge=envisioning-health-equity-art-challenge ; https://nimhd.nih.gov/programs/edu-training/art-challenge/.

[50] The website for Eye on the Future Video Contest Challenge is accessible at https://www.challenge.gov/?challenge=nei-nih-eyeonthefuture.

Advancement of Agency Mission: NEI's general purpose is to conduct and support research, training, health information dissemination and other programs with respect to blinding eye diseases, visual disorders, mechanisms of visual function, preservation of sight and the special health problems and requirements of the blind. This challenge will advance this purpose by encouraging high school students to think about and communicate why science is important for their lives. While this challenge is not limited to the science of eyes, NEI believes that youth's general exploration of science today has the potential to impact eye and vision research tomorrow.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.22. Healthy Aging Start-Up Challenge and Bootcamp to Foster Diversity and Accelerate Innovation[51]

Sponsoring Agency and Office: National Institutes of Health - National Institute on Aging

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The NIA Office of Small Business Research, in partnership with the NIA Office of Special Populations, presents the Healthy Aging Start-Up Challenge and Bootcamp to Foster Diversity and Accelerate Innovation. The goal of this challenge is to stimulate aging-related innovation and life science entrepreneurship by groups underrepresented in the U.S. biomedical sciences and by individuals developing innovations that address the unique needs of older adults from underrepresented racial and ethnic groups or those from disadvantaged backgrounds. To accomplish this goal, the challenge will provide a $60,000 cash prize to up to five challenge winners and non-cash prizes to 20 finalists comprised of resources that address unique needs and barriers faced by individuals who are seeking to develop science-driven aging innovations and for whom the SBIR funding could be especially critical to support their early-stage research, development, and commercialization activities. These resources were provided to finalists through a four-month entrepreneur bootcamp that included entrepreneurial coaching and mentorship, grant application skill building, and access to key industry networks, each of which has been identified as an area of need to foster success in the diverse research entrepreneur community.

Advancement of Agency Mission: This Challenge is consistent with the mission of the NIA, as described in 42 U.S.C. 285e, to conduct and support biomedical, social, and behavioral research, training, health information dissemination, and other programs with respect to the aging process and the diseases and other special problems and needs of the aged. This Challenge also aims to enhance equity in the NIA SBIR and STTR programs as a means to further the congressional goal of the SBIR and STTR programs under 15 U.S.C. 638 to foster and encourage participation by socially and economically disadvantaged small businesses, and by women-owned small businesses, in technological innovation.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

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[51] The website for Healthy Aging Start-Up Challenge and Bootcamp to Foster Diversity and Accelerate Innovation is accessible at https://www.challenge.gov/?challenge=healthy-aging-startup-challenge-and-bootcamp-to-foster-diversity-and-accelerate-innovation.

A.3.23. Hope for Sickle Cell Disease Challenge[52]

Sponsoring Agency and Office: National Institutes of Health - National Heart, Lung, and Blood Institute

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The National Heart, Lung, and Blood Institute (NHLBI), an institute of the National Institutes of Health (NIH), announces the NHLBI "Hope for Sickle Cell Disease Challenge" to help increase awareness about sickle cell disease and its associated complications. Sickle cell disease (SCD), also known as sickle cell anemia, is the most common genetic disorder in the United States. About 100,000 Americans are thought to be living with SCD and each year another 1,000 babies are born with it. The NHLBI is seeking to foster improved awareness about SCD and address the associated myths and stigmas by launching the NHLBI Hope for Sickle Cell Disease Challenge. This Challenge incentivizes college and graduate students to develop innovative Tools that build awareness of evidence-based information about SCD.

Advancement of Agency Mission: The mission of the NHLBI is to promote the prevention and treatment of heart, lung, and blood diseases and enhance the health of all individuals so that they can live longer and more fulfilling lives. In order to fulfill its mission, the NHLBI stimulates basic discoveries about the causes of disease, enables the translation of basic discoveries into clinical practice, fosters training and mentoring of emerging scientists and physicians, and communicates research advances to the public. The goal of this Challenge was to support the NHLBI mission by leading to increased public awareness of Sickle Cell Disease (SCD), provision of accurate and easily comprehensible information about SCD and its complication to individuals living with SCD and their caregivers and families, and improved understanding by healthcare providers about pain and opioid management for those living with SCD.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.24. I Strengthen My Nation: American Indian and Alaska Native Community Projects Created by Youth to Stand Against Substance Misuse [53]

Sponsoring Agency and Office: National Institutes of Health - National Institute on Drug Abuse

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: As part of its mission, The National Institute on Drug Abuse (NIDA) seeks to identify intervention strategies to combat drug addiction. Recognizing that youth voices and creativity are critical to this goal, NIDA announces "I Strengthen My Nation: American Indian and Alaska Native Community Projects Created by Youth to Stand Against Substance Misuse" in partnership with the Northwest Portland Area Indian Health Board's We R Native program. NIDA invites all youth ages 14-25, ideally with a deep knowledge of AI/AN culture, to participate in a highly competitive, exciting challenge

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[52] The website for Hope for Sickle Cell Disease Challenge is accessible at https://www.nhlbi.nih.gov/grants-and-training/sickle-cell-challenge ; https://www.challenge.gov/?challenge=NHLBI-hope-for-sickle-cell-disease-challenge.

[53] The website for I Strengthen My Nation: American Indian and Alaska Native Community Projects Created by Youth to Sta is accessible at https://nida.nih.gov/research/nida-research-programs-activities/nida-challenges-program/strengthen_my_nation/community_projects.

benefitting their own communities. Individually or in groups, applicants will submit 1) a proposal for a project, including a budget, that will enhance resiliency to substance misuse in their communities, and 2) an accompanying a video that creatively describes what they see as resilience against substance misuse, how it relates to indigenous culture, and how the proposed project will enhance resiliency in their community. The video should be crafted so that viewers are inspired by the ideas and could consider doing the same sort of project in their own community. The budget should include enough detail and explanation of costs so that other communities could use it as a guide.

Advancement of Agency Mission: The general purpose of NIDA is to conduct and support biomedical and behavioral research, health-services research, research training, and health-information dissemination with respect to the prevention of drug abuse and the treatment of drug abusers. This Challenge is consistent with and advances the mission of NIDA as described in 42 U.S.C. 285o in that it seeks to identify intervention strategies to combat drug addiction.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.25. I Strengthen My Nation: Artistic Expressions of Resilience to Stand Against Substance Misuse[54]

Sponsoring Agency and Office: National Institutes of Health - National Institute on Drug Abuse

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The National Institute on Drug Abuse (NIDA), a component of the National Institutes of Health (NIH), is a biomedical research organization committed to finding cutting edge strategies to combat substance misuse. Recognizing the inspiration and creativity of youth, NIDA announces "I Strengthen My Nation: Artistic Expressions of Resilience to Stand Against Substance Misuse" in partnership with the Northwest Portland Area Indian Health Board's We R Native program. Resilience is the processes that individuals, families and communities use to cope, adapt and take advantage of assets when facing significant acute or chronic stress, or the compounding effect of both together. NIDA invites all youth ages 14-25, ideally with a deep knowledge of AI/AN culture, to participate in an original art competition expressing resilience. Participants will innovatively address substance misuse individually or in groups by submitting 1) any original form of art (print, dance, theater, carving, beadwork, etc.), 2) a brief written response explaining how the artwork depicts resilience against drug misuse, and 3) a written explanation of their knowledge of AI/AN culture.

Advancement of Agency Mission: The general purpose of NIDA is to conduct and support biomedical and behavioral research, health-services research, research training, and health-information dissemination with respect to the prevention of drug abuse and the treatment of drug abusers. This Challenge is consistent with and advances the mission of NIDA as described in 42 U.S.C. 285o in that it seeks to identify intervention strategies to combat drug addiction.

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[54] The website for I Strengthen My Nation: Artistic Expressions of Resilience to Stand Against Substance Misuse is accessible at https://nida.nih.gov/research/nida-research-programs-activities/nida-challenges-program/artistic_expressions_resilience.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.26. Innovative Technology Solutions for Social Care Referrals[55]

Sponsoring Agency and Office: Administration for Community Living

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: ACL launched in March, 2020 a competition for state and community leaders in the aging and disability network, health care systems, health plans, and health IT vendors to cultivate care coordination by developing and optimizing interoperable and scalable technology solutions that demonstrate seamless network integration. Technology-based platforms that enable linkages between healthcare providers and the existing ecosystem of community-based, social service organizations were challenged to support more efficient referral processes and better-informed decision-making, ensuring that individuals are seamlessly connected to resources that address their preferences, goals, values, and social determinants in ways that promote independence in the community. Participating teams worked collaboratively on enhancing scalable approaches to securely sharing standardized data on social determinants of health and using open resource directories. This included developing prototypes and implementing technical solutions that track referral patterns and gaps in service that visibly display social service and health related outcomes overtime. The Challenge competed across three phases, and a bonus phase, with a total of $1 million in award prizes. Phase 1 teams presented design and concept proposals for solutions that facilitate social referrals through closed loop functionalities and that enable more efficient data sharing across health and human services organizations. In Phase 2, teams demonstrated the use of standards for referral data collection and exchange and offered enhanced use cases for the technical functionalities presented in Phase 1. Teams also focused on identifying a collaborative governance model with confirmed collaborators, defined roles and responsibilities, data agreements, and end user workflows for their proposed solutions. Finalists in Phase 3 completed pilot testing of interoperability functionalities and proved replicability and scalability of their project.

Advancement of Agency Mission: The Administration for Community Living's mission is to 'Maximize the independence, well-being, and health of older adults, people with disabilities across the lifespan, and their families and caregivers'. Through the Social Care Referrals Challenge, ACL aims to support increased access to social services through referrals from health care. By enhancing technology solutions that enable linkages between healthcare providers and the existing ecosystem of community-based, social service organizations that more efficiently share standardized data to support referral processes and better informed decision-making, ACL can ensure that individuals, whether older adults, people with disabilities across the lifespan, or their families and caregivers are seamlessly connected to resources that address their preferences, goals, values, and social determinants in ways that promote independence in the community for as long as possible.

Plan for Upcoming Two Fiscal Years: N/A

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[55] The website for Innovative Technology Solutions for Social Care Referrals is accessible at https://acl.gov/socialcarereferrals.

A.3.27. LitCoin Natural Language Processing Challenge[56]

Sponsoring Agency and Office: National Institutes of Health - National Center for Advancing Translational Sciences

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Biomedical researchers need to be able to use open scientific data to create new research hypotheses and lead to more treatments for more people more quickly. Reading all of the literature that could be relevant to their research topic can be daunting or even impossible, and this can lead to gaps in knowledge and duplication of effort. Transforming knowledge from biomedical literature into knowledge graphs can improve researchers' ability to connect disparate concepts and build new hypotheses, and can allow them to discover work done by others which may be difficult to surface otherwise. To advance some of the most promising technology solutions built with knowledge graphs, the National Institutes of Health (NIH) and its collaborators are launching the LitCoin NLP Challenge. This challenge aims to (1) help data scientists better deploy their data-driven technology solutions towards accelerating scientific research in medicine and (2) ensure that data from biomedical publications can be maximally leveraged and reach a wide range of biomedical researchers; together this will drive toward solutions for the critical problems these scientists aim to solve. Participants will be challenged to develop NLP systems with the ability to identify concepts from a biomedical publication and link them together into relationships to create well-linked and carefully defined knowledge graphs for each publication.

Advancement of Agency Mission: NCATS was established to coordinate and develop resources that leverage basic research in support of translational science and to develop partnerships and work cooperatively to foster synergy in ways that do not create duplication, redundancy and competition with industry activities. This challenge will spur innovation in NLP to advance the field and allow the generation of more accurate and useful data from biomedical publications, which will enhance the ability for data scientists to create tools to foster discovery and generate new hypotheses. This promotes the development of resources for basic science research, as well as developing partnerships with software designers in the NLP space.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.28. LitCoin Pilot Design Challenge[57]

Sponsoring Agency and Office: National Institutes of Health - National Center for Advancing Translational Sciences

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Increasing the accessibility and usability of biomedical knowledge is an important and difficult goal which NIH has emphasized for years. To make strides toward this goal,

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[56] The website for LitCoin Natural Language Processing Challenge is accessible at https://ncats.nih.gov/funding/challenges/litcoin.

[57] The website for LitCoin Pilot Design Challenge is accessible at https://www.challenge.gov/?challenge=litcoin-pilot-design-challenge.

researchers will need to generate computationally-accessible knowledge at the time of publication, as opposed to relying on post-hoc data generation and expensive post-curation of knowledge. To advance the field of biomedical research by utilizing some of the most promising technology solutions built with knowledge graphs, NCATS and its collaborators have launched the LitCoin program. This program aims to 1) increase FAIRness of scientific findings, 2) help data scientists deploy their data-driven technology solutions to accelerate scientific research, 3) ensure that data from biomedical publications can be leveraged by a wide range of biomedical researchers and drives the impact of the critical problems they aim to solve. This challenge will spur the creation of innovative strategies for building a submission platform capable of accepting free text describing research findings, running NLP algorithms on that free text to generate knowledge graphs representing the text, allowing the authors to curate these knowledge graphs, and presenting the authors with similar knowledge assertions extracted from published research. Authors should have the opportunity to submit their research to publisher-partners to facilitate the review of both the free text submission and the associated knowledge graph.

Advancement of Agency Mission: NCATS was established to coordinate and develop resources that leverage basic research in support of translational science, and to develop partnerships and work cooperatively to foster synergy in ways that do not create duplication, redundancy, and competition with industry activities. This challenge will spur innovation in the way that researchers publish their work, allowing for the generation of more accurate and useful data from biomedical publications, which will enhance the ability for data scientists to create tools to foster discovery and generate new hypotheses. This promotes the development of resources for basic and translational science research, and will likely lead to partnerships with publishers which will allow for innovation in the sharing of research outcomes across all fields of research.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.29.   Long COVID Computational Challenge (L3C)[58]

Sponsoring Agency and Office: National Institutes of Health - Office of the Director

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The National Institutes of Health, through the Office of the Director, is launching the NIH Long COVID Computational Challenge (L3C). The overall prevalence of post-acute sequelae of SARS-CoV-2 (PASC), also known as Long COVID, is currently unknown, but there is growing evidence that more than half of COVID-19 survivors experience at least one symptom of PASC/Long COVID at six months after recovery of the acute illness. Reports also reflect an underlying heterogeneity of symptoms, multi-organ involvement, and persistence of PASC/Long COVID in some patients. Research is ongoing to understand prevalence, duration, and clinical outcomes of PASC/Long COVID. The primary objective of the Challenge is to spur and reward the development of AI/ML models and algorithms that serve as open-source tools for using structured medical records to identify which patients infected with SARS-CoV-2 have a high likelihood of developing PASC/Long COVID. This Challenge invites solutions that explore the probability of developing PASC/Long COVID among patients who have tested positive for SARS-CoV-2 in an outpatient or inpatient (ICU or non-ICU) setting. Models will be evaluated using

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[58]   The   website   for   Long   COVID   Computational   Challenge   (L3C)   is   accessible   at https://www.challenge.gov/?challenge=l3c.

patients who have an ICD code U09.9 recorded in the dataset to label true positive of patients with PASC/Long COVID.

Advancement of Agency Mission: This challenge will improve our understanding about who are at risk for PASC/Long COVID and how to identify these patients earlier. PASC/Long COVID have been recognized as conditions that cause lingering illness and persistent health problems. Thus, this challenge is consistent with the mission of the NIH to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.30. LymeX Diagnostics Prize[59]

Sponsoring Agency and Office: HHS Office of the Assistant Secretary for Health (OASH)

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The goal of the LymeX Diagnostics Prize is to develop diagnostics that can accurately detect active Lyme disease infections in people. The multiphase competition will nurture the development of innovative solutions toward Food and Drug Administration review. Phase 1 awarded $1 million. At the discretion of HHS and the Steven & Alexandra Cohen Foundation, and subject to availability of future funding, at least one additional phase may follow Phase 2. Future phases are expected to focus on clinical and nonclinical validation of diagnostic test(s) that detect active infection by Lyme-disease-causing bacteria, as well as readiness for regulatory submission and market entry. Thanks to a $10 million pledge to the LymeX Diagnostics Prize from the Steven & Alexandra Cohen Foundation, $9 million in additional LymeX prizes are projected to be available to proposed future phases.

Advancement of Agency Mission: Lyme disease is the most common vector-borne disease in the United States, and the number of cases continue to grow at an alarming rate. According to the CDC, approximately 476,000 Americans are diagnosed with and treated for Lyme each year. To help address this complex healthcare challenge, HHS is leading an interagency process to develop a ground-breaking national strategy to address vector-borne diseases, including Lyme disease. Per the Kay Hagan Tick Act of 2019, the National Strategy on Vector-Borne Diseases Report will be delivered to Congress in 2023. Development of new diagnostic technologies is expected to be a major pillar of this strategy.

Plan for Upcoming Two Fiscal Years: Phase of the LymeX Diagnostics Prize is currently underway, expected to make awards in FY2023. Phase 3 is in planning stages with a proposed launch following the completion of Phase 2.

A.3.31. LymeX Education and Awareness Healthathon[60]

Sponsoring Agency and Office: HHS Office of the Assistant Secretary for Health (OASH)

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[59] The website for LymeX Diagnostics Prize is accessible at https://www.lymexdiagnosticsprize.com; https://www.challenge.gov/?challenge=lymex-diagnostics-prize&tab=overview.

[60] There was no website provided for LymeX Education and Awareness Healthathon.

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: LymeX Education and Awareness Healthathon was an innovation challenge for the public to create educational materials (for example, social media content, educational or training videos, graphics, or posters) to help raise awareness about how to recognize the signs and symptoms of Lyme disease, how to prevent tick bites, how to recognize a tick, what to do if you've been bitten, or when to seek medical care.

Advancement of Agency Mission: Lyme disease is the most common vector-borne disease in the United States, and the number of cases continue to grow at an alarming rate. According to the CDC, approximately 476,000 Americans are diagnosed with and treated for Lyme each year. To help address this complex healthcare challenge, HHS is leading an interagency process to develop a ground-breaking national strategy to address vector-borne diseases, including Lyme disease. Per the Kay Hagan Tick Act of 2019, the National Strategy on Vector-Borne Diseases Report will be delivered to Congress in 2023. Development of new diagnostic technologies is expected to be a major pillar of this strategy.

Plan for Upcoming Two Fiscal Years: HHS will showcase Healthathon education materials through the HHS Lyme Innovation initiative and LymeX public-private partnership.

A.3.32.   Mapping Patient Journeys in Drug Addiction Treatment[61]

Sponsoring Agency and Office: National Institutes of Health - National Institute on Drug Abuse

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The National Institute on Drug Abuse (NIDA), one of the components of the National Institutes of Health (NIH), is announcing the "Mapping Patient Journeys in Drug Addiction Treatment" Challenge. The Challenge goal is to inspire the creation of actionable patient journey maps that might further the understanding of the obstacles that patients face in getting treatment for drug addiction, particularly while our country is in the middle of an ongoing opioid crisis. Substance Use Disorder (SUD) is a complex but treatable condition, and most SUD patients are likely to need ongoing treatment and recovery support using a chronic care model for several years. Visually mapping the patient journey allows any organization involved in providing health care to understand the patient experience by breaking it down into a series of steps. NIDA is eager to challenge everyone with access to and knowledge of SUD patient communities to design patient journey maps that are both comprehensive and accessible. NIDA expects that the contest will allow participants to identify specific points during the patient journey where patients encounter the most difficulty, thereby enabling NIDA to focus new research efforts into alleviating those areas of difficulty in patients' drug addiction treatment journeys.

Advancement of Agency Mission: he general purpose of NIDA is to conduct and support biomedical and behavioral research, health-services research, research training, and health-information dissemination with respect to the prevention of drug use and the treatment of drug addiction. This Challenge is consistent with and advances the mission of NIDA as described in 42 U.S.C. 285o in that it seeks to identify intervention strategies to combat drug addiction.

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[61] The website for Mapping Patient Journeys in Drug Addiction Treatment is accessible at https://www.challenge.gov/?challenge=mapping-patient-journeys-in-drug-addiction-treatment.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.33. Mask Innovation Challenge[62]

Sponsoring Agency and Office: Administration for Strategic Preparedness and Response; Biomedical Advanced Research and Development Authority (BARDA)

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The BARDA Division of Research, Innovation, and Ventures (DRIVe) partnered with the National Institute for Occupational Safety and Health (NIOSH) and the National Institute of Standards and Technology (NIST) to launch Phase 2 of the Mask Innovation Challenge: Building Tomorrow's Mask. The overall goal of the Challenge was to support the development of evidence-based and scientifically validated mask designs that could be used during future pandemics and public health emergencies, as well as everyday use, to help reduce people's exposure to a variety of respiratory threats, such as allergy season, wildfire smoke, pollution, seasonal flu, and other infectious diseases. Phase 1 of the Mask Innovation Challenge sought great ideas on paper for next generation masks and face barrier covering concepts. The second phase of the Mask Innovation Challenge represents a bold step in reimagining respiratory protective devices that can protect the wearer from a variety of airborne hazards. The goal is to accelerate the development of next generation masks that have multi-hazard protection and aim to meet performance and design criteria of the Moonshot Target Product Profile (TPP).

Advancement of Agency Mission: The prize was consistent with BARDA DRIVe's mission to support the development of unique medical countermeasures that can be used during public health emergencies. Both Phase 1 and 2 of this prize competition spurred new innovations for mask designs in a sector that has remained relatively stagnant for many years. Overall, this challenge enabled BARDA to engage with a new pool of innovators to develop impactful and innovative medical countermeasures that could be used during the COVID-19 pandemic.

Plan for Upcoming Two Fiscal Years: BARDA will continue to explore the use of prize competitions and other pull incentives to encourage countermeasure development and enable BARDA to establish cash prizes contingent on meeting clear sets of success criteria among competition R&D organizations. In addition, BARDA will leverage prizes to help 1) create high visibility to address health security problems, sometimes when the approach or development path is not known 2) increase the diversity and reach of organizations to engage in MCM R&D development and 3) develop solutions that meet bold and ambitious goals that thrive beyond prize award.

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[62] The website for Mask Innovation Challenge is accessible at https://drive.hhs.gov/mask-innovation-challange.html.

A.3.34. Minimizing Bias & Maximizing Long-term Accuracy of Predictive Algorithms in Healthcare[63]

Sponsoring Agency and Office: National Institutes of Health - National Center for Advancing Translational Sciences

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Although artificial intelligence (AI) and machine learning (ML) algorithms offer promise for clinical decision support (CDS), that potential has yet to be fully realized in the clinic. Even well-designed AI/ML algorithms and models can become inaccurate or unreliable over time due to various factors; changes in data distribution, subtle shifts in the data, real world interactions, user behavior, and shifts in data capture and management practices can have repercussions for model performance. These subtle shifts over time can cause degradation of the predictive capability of an algorithm, which can effectively negate the benefits of these types of systems in the clinic. Monitoring of an algorithm's behavior and flagging of any material drifts in performance may enable timely adjustments that ensure the model's predictions remain accurate, fair, and unbiased over time. In this way, degradation of the predictive capability of the algorithm when applied in the real world may be prevented. NIH's NCATS challenges participants to create a solution that detects bias in AI/ML models used in clinical decisions.

Advancement of Agency Mission: NCATS was established to coordinate and develop resources that leverage basic research in support of translational science and to develop partnerships and work cooperatively to foster synergy in ways that do not create duplication, redundancy, and competition with industry activities. This Challenge will further the mission of NCATS by spurring innovation in the AI bias mitigation space - both identification and minimizing inadvertent amplification/perpetuation of systemic biases - in AI/ML algorithms utilized as CDS tools in the healthcare setting. Through this Challenge, innovators will create tools to foster and promote the use of predictive and social bias detection and correction in order to increase the accuracy of CDS algorithms in healthcare settings.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.35. NCTR Indel Calling from Oncopanel Sequencing Data Challenge[64]

Sponsoring Agency and Office: Food and Drug Administration

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The high value of clinically actionable information obtained by oncopanel sequencing makes it a crucial tool for precision oncology. With the surge in availability of oncopanels, it is critical to ensure that they have been thoroughly tested and are properly used. Indels in coding region disrupt protein coding and often lead to changes in protein function. Given that indels have not

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[63] The website for Minimizing Bias & Maximizing Long-term Accuracy of Predictive Algorithms in Healthcare is accessible at https://www.challenge.gov/?challenge=minimizing-bias-and-maximizing-long-term-accuracy-of-predictive-algorithms-in-healthcare.

[64] The website for NCTR Indel Calling from Oncopanel Sequencing Data Challenge is accessible at https://precision.fda.gov/challenges/21; https://precision.fda.gov/challenges/22/results.

been studied as much as single nucleotide variants, it is important that the tools for indel-calling be rigorously evaluated and optimized. To this end, precisionFDA and the FDA's National Center for Toxicological Research (NCTR) teamed up to launch the NCTR Indel Calling from Oncopanel Sequencing Data Challenge! This challenge asked the participants to develop, validate, and benchmark indel calling pipelines to identify indels in the oncopanel sequencing datasets. In total, submissions of 48 pipelines from 21 teams were received in the two phases of the challenge. This work will advance the fit-for-purpose use of Next Generation Sequencing (NGS) oncopanel sequencing to inform regulatory science research and precision oncology.

Advancement of Agency Mission: Participants have been identified for further manuscript development. This development will further innovate in this area and Top Performers presented their results and methods during the FDA/NCTR – Massive Analysis and Quality Control Society (MAQC) 2022 Conference. This also helps broaden the community to further advance the mission and contribute to regulatory science.

Plan for Upcoming Two Fiscal Years: PrecisionFDA is planning additional public challenges in the next two years, with a goal of having four a year. Topics may include race and ethnicity in electronic health records, software as a medical device, and other emerging topics.

A.3.36.   NIH Prize for Enhancing Faculty Gender Diversity in Biomedical and Behavioral Science[65]

Sponsoring Agency and Office: National Institutes of Health - Office of the Director

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Women continue to be underrepresented at nearly every institution of higher education in the United States in the fields of biomedical, behavioral sciences, and engineering. This is particularly true among mid- to senior-level faculty ranks. NIH has taken steps to address this issue through the launch of the NIH Prize for Enhancing Faculty Gender Diversity in Biomedical and Behavioral Science. This Prize recognizes institutions whose biomedical and behavioral science departments, centers, or divisions have achieved sustained improvement in gender diversity. Understanding that there is not a "one-size-fits-all" solution to enhance diversity in academia and that ideas based on evidence are necessary to achieve systemic change, this prize acknowledges and recognizes transformative approaches, systems, projects, programs, and processes that have successfully enhanced and sustained gender diversity within an institution. NIH has awarded $50,000 each to 10 institutions for their efforts in enhancing faculty gender diversity. All prize recipients and honorable mentions substantially contribute to systemic change aimed at addressing gender diversity and equity issues among faculty members within their institutions' biomedical and behavioral science departments. ORWH hosted a forum to recognize the winning institutions and honorable mentions in partnership with the American Association for the Advancement of Science (AAAS) STEMM Equity Achievement (SEA) Change initiative and in collaboration with the National Academies of Sciences, Engineering, and Medicine's Committee on Women in Science, Engineering, and Medicine. The forum presented the winners' effective, evidence-based practices and featured four panels exploring challenges and discussing ways to improve the existing career paradigm for many women in biomedical and behavioral science. The practices and strategies presented at this forum will help foster supportive

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[65] The website for NIH Prize for Enhancing Faculty Gender Diversity in Biomedical and Behavioral Science is accessible at https://www.challenge.gov/?challenge=nih-prize-for-enhancing-faculty-gender-diversity.

and inclusive environments at academic and research institutions in which women faculty members can further their careers and remove barriers to implementing transformative change.

Advancement of Agency Mission: Advancement of Agency Mission: This prize competition is consistent with ORWH's mission to improve the advancement of women in biomedical careers, as described in 42 U.S.C. 287d, including efforts directed towards the representation of women among researchers. This prize competition is consistent with ORWH's charge to develop opportunities for, and to support recruitment, retention, reentry, and advancement of, women in biomedical careers.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.37.   NIH Technology Accelerator Challenge (NTAC) for Maternal Health[66]

Sponsoring Agency and Office: National Institutes of Health - National Institute of Biomedical Imaging and Bioengineering

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The NIH Technology Accelerator Challenge (NTAC) for Maternal Health offered $1,000,000 in cash prizes for innovative diagnostic technologies to help improve maternal health around the world. Pregnancy and childbirth complications are a major global health problem, resulting in the deaths of more than 800 women and 7,000 newborns each day. Contributing to the high rates of maternal morbidity and mortality in low-resource settings is a lack of low-cost diagnostics that operate at the point-of-care and are capable of detecting and differentiating common conditions associated with pregnancy. NTAC Maternal Health sought to spur and reward the development of prototypes for low-cost, point-of-care molecular, cellular, and/or metabolic sensing and diagnostic technologies to guide rapid clinical decision-making, improve patient outcomes, and ultimately prevent maternal morbidity and mortality. To win NTAC: Maternal Health, participants were required to: (1) Submit their design for a point-of-care diagnostic test or platform technology with initial feasibility data or references addressing at least two of the four priority conditions affecting maternal health during antenatal and intrapartum periods; and (2) Submit a robust description of the proposed path for translation and further development of the diagnostic technology for use in global health settings.

Advancement of Agency Mission: This Challenge is consistent with and promotes the general purpose of NIBIB which, as described in 42 U.S.C. 285r, is to conduct and support research, training, the dissemination of health information, and other programs with respect to biomedical imaging, biomedical engineering, and associated technologies and modalities with biomedical applications. This Challenge will reward and spur the development of sensing and diagnostic technologies to facilitate and guide clinical decision making to improve maternal health.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

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[66] The website for NIH Technology Accelerator Challenge (NTAC) for Maternal Health is accessible at https://www.challenge.gov/?challenge=ntac2021.

A.3.38. Neuromod Prize - Phase 1[67]

Sponsoring Agency and Office: National Institutes of Health - Office of the Director

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Neuromod Prize is a SPARC (Stimulating Peripheral Activity to Relieve Conditions) initiative from the National Institutes of Health (NIH) that is accelerating the development of targeted neuromodulation therapies. The NIH SPARC program aims to help treat conditions by identifying neural targets and accelerating the development of devices that can regulate organ function by modulating autonomic nerve activity. With this Competition, NIH hopes to bridge the gap between early-stage research and clinical application of solutions capable of targeting multiple autonomic functions through selective stimulation of the peripheral nervous system. The first phase of the competition calls on scientists, engineers, and clinicians to submit novel concepts and plans for development. The primary component of a submission will be a concept paper that summarizes the proposed targeted neuromodulation therapy. The proposed solution should be tunable, accurate, and precise, and should demonstrate an ability to quantitatively assess and control multiple on-target and related off-target effects.

Advancement of Agency Mission: The NIH Common Fund is a component of the NIH budget which is managed by the Office of Strategic Coordination/Division of Program Coordination, Planning, and Strategic Coordination/Office of the NIH Director. Common Fund programs address emerging scientific opportunities and pressing challenges in biomedical research that no single NIH Institute or Center (IC) can address on its own, but are of high priority for the NIH as a whole [42 U.S.C. 282a(c)(1)]. The SPARC program is supported by the NIH Common Fund to provide a scientific and technological foundation for future neuromodulation medical devices and protocols. The goal of the SPARC program is to identify neural targets and accelerate the development of therapeutic devices that modulate electrical activity in the vagus and other nerves to help treat diseases and conditions by precisely adjusting organ function. This Competition is consistent with and promotes the agency's mission by catalyzing the goal-driven development of innovative tools and technologies with the potential to enhance human health.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.39. Open Data for Good Challenge: COVID-19 and Health[68]

Sponsoring Agency and Office: Office of the Secretary

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: One of the greatest challenges associated with public interest technology (or civic technology) development is product sustainability and adoption. Open data is used to create many products for the public good, but the teams who built these products often face challenges in deploying and maintaining them. To advance some of the most promising technology solutions built

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[67] The website for Neuromod Prize - Phase 1 is accessible at https://www.challenge.gov/?challenge=neuromodprize-phase1.

[68] The website for Open Data for Good Challenge: COVID-19 and Health is accessible at https://www.challenge.gov/?challenge=open-data-for-good-grand-challenge.

with open data, the Census Bureau and its collaborators are launching the Open Data for Good Grand Challenge. This Challenge aims to 1) help technologists and their collaborators better deploy their data-driven technology solutions, ensure they reach end users, and drive impact of the critical problems they aim to solve, and 2) to reward exemplary uses of federal open data. This challenge is open to: anyone who participated or participates in The Opportunity Project sprints or TOPx sprints in 2020 or 2021 (between the dates of 1/1/2020 and 10/24/2021); and anyone in the general public who follows The Opportunity Project methodology via TOP's public product development toolkit to create a user-centered digital tool using federal open data in 2020 or 2021 (between the dates of 1/1/2020 and 10/24/2021).

Advancement of Agency Mission: This challenge is a full-length, interagency TOP sprint that will build upon prior COVID-19 Design-a-thon and TOPx sprints to deliver COVID-19 and health solutions in collaboration with industry and non-government sectors.

Plan for Upcoming Two Fiscal Years: N/A

A.3.40. PandemicX Accelerator[69]

Sponsoring Agency and Office: Office of the Secretary

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The PandemicX Accelerator (PandemicX) is a six-month pilot program designed to build and scale technologies with businesses fueled by HHS data and healthcare innovation. This InnovationX initiative is jointly sponsored by the HHS Office of the Assistant Secretary for Health (OASH) and the Office of the National Coordinator for Health IT (ONC) and managed by MassChallenge HealthTech, a non-profit organization dedicated to supporting innovation and entrepreneurship through collaboration and development. Between December 2021 and June 2022, in the inaugural PandemicX cohort, 15 teams of entrepreneurs connected their health start-ups with government leaders on HHS priorities like health equity and access to care in the MassChallenge Health Tech 2022 Partner Challenge. ONC and OASH InnovationX created PandemicX statements—each an innovation challenge area—designed to focus on start-ups and engage tech-sector collaborators. Participating start-ups designed and deployed digital solutions for public health with an emphasis on ensuring an equitable COVID-19 response and recovery for all.

Advancement of Agency Mission: Between December 2021 and June 2022, in the inaugural PandemicX cohort, 15 teams of entrepreneurs connected their health start-ups with government leaders on HHS priorities like health equity and access to care in the MassChallenge Health Tech 2022 Partner Challenge exit disclaimer icon. ONC and OASH InnovationX created PandemicX statements—each an innovation challenge area—designed to focus on start-ups and engage tech-sector collaborators. Participating start-ups designed and deployed digital solutions for public health with an emphasis on ensuring an equitable COVID-19 response and recovery for all.

Plan for Upcoming Two Fiscal Years: N/A

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[69] The website for PandemicX Acclerator is accessible at https://www.hhs.gov/ash/osm/innovationx/pandemicx/index.html.

A.3.41.　Product Prototypes to Combat Drug Craving[70]

Sponsoring Agency and Office: National Institutes of Health - National Institute on Drug Abuse

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The National Institute on Drug Abuse (NIDA), one of the components of the National Institutes of Health (NIH), is announcing the "Product Prototypes to Combat Drug Craving" Challenge. The Challenge goal is to solicit working prototypes of multifaceted products that will help with drug craving in people who experience substance use problems or with substance use disorder (SUD). Ideally, these multifaceted product prototypes would combine several different tools or features to address drug craving, providing long-term, on-demand, and personalized comprehensive assistance that can ultimately reduce the likelihood of return to use (also known as recurrence). NIDA expects that the Challenge will inspire many different product prototypes to help people address their drug cravings and prevent recurrence of drug use.

Advancement of Agency Mission: The general purpose of NIDA is to conduct and support biomedical and behavioral research, health-services research, research training, and health-information dissemination with respect to the prevention of drug use and the treatment of drug addiction. As this Challenge is consistent with and advances the mission of NIDA as described in 42 U.S.C. 285o in that it seeks to identify intervention strategies to combat drug addiction and drug craving, submissions regarding alcohol use disorder will not be accepted.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.42.　Promoting Pediatric Primary Prevention (P4) Challenge[71]

Sponsoring Agency and Office: Health Resources and Services Administration

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Within months of the COVID-19 pandemic, CDC data showed declining rates of vaccinations and well-child visits among pediatric populations. The CDC reports that declines in vaccination coverage might leave young children and communities vulnerable to vaccine-preventable diseases such as measles. Well-child visits are an important venue for vaccine administration and documentation. Providers also screen for developmental delays. Parents can raise concerns about a child's physical problems, behavior, and mental health and receive personalized guidance on healthy nutrition, exercise, and safety. We developed this prize competition to support solutions to this issue, supporting communities in their efforts to make sure children receive the well-child checkups and the vaccinations that they need to grow and stay healthy. There were two phases to this competition with a total prize purse of $1 million. During Phase I, applicants submitted proposals describing their innovative approach aimed at increasing key pediatric health performance measures such as: Number of well-child visits (number of visits/number of children in the target population); Well-child visit

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[70]　The website for Product Prototypes to Combat Drug Craving is accessible at https://www.challenge.gov/?challenge=product-prototypes-to-combat-drug-craving-challenge.

[71]　The website for Promoting Pediatric Primary Prevention Challenge is accessible at https://mchb.hrsa.gov/funding/challenge-competitions/p4challenge.

disparities (comparing measures across two or more subpopulations); Doses administered of specific vaccines; coverage of the primary pediatric vaccination series (for example, number of MMR vaccines given/number of children 12-18 months in the target population); Disparities within the community on a specific immunization metric (comparing measure across two or more subpopulations). At the end of Phase I, 50 winners received $10,000 each and used their prize money to deploy their proposed approaches in Phase 2. During Phase II, teams gathered data to track their progress and to report outcomes. At the end of Phase II, 20 final winning teams received $25,000 each.

Advancement of Agency Mission: HRSA's MCHB's mission is to improve the health and well-being of America's mothers, children, and families. The innovative solutions supported by the P4 Challenge resulted in addressing a key challenge facing this population. Innovative solutions resulted in not only the administration of 22,942 immunizations and 52,177 well-child visits, but the collection of best practices in improving vaccination uptake and well-visits that have been shared nationwide.

Plan for Upcoming Two Fiscal Years: N/A

A.3.43.   RADx Tech for Maternal Health Challenge[72]

Sponsoring Agency and Office: National Institutes of Health - Eunice Kennedy Shriver National Institute of Child Health and Human Development

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Rapid Acceleration of Diagnostics Technology (RADx® Tech) for Maternal Health Challenge will award up to $8 million in prizes to accelerate the development of home-based and point-of-care maternal health diagnostic devices, wearables, or other remote sensing technologies. Successful technologies will enable extension of care (e.g., empower individuals with actionable health information they can use to inform their decisions about when to seek additional care) and ultimately reduce severe maternal morbidity and maternal mortality for individuals residing in maternity care deserts during the first year of the postpartum period. Innovators participating in this challenge will submit a proposal describing in detail their prototype technology, anticipated clinical impact, and plans for continued development. These proposals will be reviewed during the Viability Assessment Phase from which selected winners will advance to the Deep Dive Assessment Phase. During the Deep Dive Phase, a Project Team of healthcare technology commercialization and content experts will engage directly with each Innovator to assess the prototype technology across defined Evaluation Criteria and will work with NIH to identify key risk factors for accelerated development and implementation and establish milestones that mitigate these risks, subject to final decisions by NIH. Innovators selected in the Deep Dive Phase will advance to the Technology Assessment Phase where they will rapidly de-risk their technologies with in-kind technical, clinical, and commercialization support and compete for an additional cash prize for successful milestone completion. At the end of the Technology Assessment Phase, Innovators will submit their technologies for independent testing and verification of performance and usability. Those Innovators whose technologies successfully complete the final phase will be rewarded with a cash prize and connected to NIH-funded research networks and centers.

Advancement of Agency Mission: The mission of the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) includes improving reproductive health, enhancing the lives

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[72] The website for RADx Tech for Maternal Health Challenge is accessible at https://www.challenge.gov/?challenge=radx-tech-maternal-health.

of children and adolescents, and optimizing abilities for all, and its vision is "Healthy pregnancies. Healthy children. Healthy and optimal lives." This challenge aligns with NICHD's statutory authority and promotes its mission and vision by accelerating the development of innovative technologies that will help ensure every person has a healthy pregnancy and improve overall maternal health outcomes. NICHD and its partners are conducting this Challenge as part of the NIH IMPROVE Initiative which supports research focused on reducing preventable causes of maternal deaths and improving health for women before, during, and after delivery.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.44. STRIVE for Change: Drawing on Our Strengths Challenge[73]

Sponsoring Agency and Office: National Institutes of Health - Eunice Kennedy Shriver National Institute on Child Health and Human Development

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Building off the work of the NICHD's STrategies to enRich Inclusion and achieVe Equity (STRIVE) initiative, the STRIVE for Change: Drawing on our Strengths Art Challenge is soliciting single, still graphic art submissions that focus on one or more community that experience health disparities. The artwork should highlight ways that people in the community manage adversity and promote resilience to promote positive health outcomes. Artwork should address a specific type of disadvantage that results in poorer health outcomes and focus on practices by or characteristics of the people in the community, such as events, ways of sharing resources and information, and cultural traditions, that address the disadvantage as well as highlight community strengths. This challenge provides participants with the opportunity to express their voices and perspectives.

Advancement of Agency Mission: The NICHD is authorized and established by section 448 of the Public Health Service Act, codified at 42 U.S.C. § 285g to conduct and support research, training, health information dissemination, and other programs with respect to gynecologic health, maternal health, child health, intellectual disabilities, human growth, and development, including prenatal development, population research, and special health problems and requirements of mothers and children. The Challenge is consistent with and advances the mission of NICHD by addressing health disparities via engaging the community in identifying health promoting solutions.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.45. Speaking Up About Mental Health! This is My Story Challenge[74]

Sponsoring Agency and Office: National Institutes of Health - National Institute of Mental Health

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[73] The website for STRIVE for Change: Drawing on Our Strentgths Challenge is accessible at https://www.challenge.gov/?challenge=nichdartchallenge.

[74] The website for Speaking Up About Mental Health! This is My Story Challenge is accessible at https://www.challenge.gov/?challenge=speaking-up-about-mental-health%21-this-is-my-story.

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Speaking Up About Mental Health! This is My Story is an essay contest for high school students ages 16-18 to raise the awareness of mental health. The contest aims to provide students with an opportunity for self-expression about ways to eliminate and/or reduce mental health stigma that young people may need to overcome when seeking mental health treatment. Through these short essays, teens can express their own thoughts and ideas about the mental health challenges they and their peers face. They can also share possible solutions for improving communication and understanding among teens, parents, teachers, guardians, and other caregivers.

Advancement of Agency Mission: This contest advances the agencies mission by raising awareness of mental health among American youth and their families, promoting communication among teens, parents, guardians, and other caregivers to seek help for mental health issues, and by providing students the opportunity for self-expression about a mental health concern.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.3.46. The Air you Wear Challenge[75]

Sponsoring Agency and Office: National Institutes of Health - National Heart, Lung, and Blood Institute

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Over 1.5 million Americans are prescribed supplemental oxygen for use outside the hospital for a range of medical conditions. Although there are different options available for how outpatients receive supplemental oxygen, the issues associated with the therapeutic goals and optimal use of home oxygen continue to be considered and are not considered solved. Patients consistently express concerns around the following issues particularly: having an oxygen supply be lighter and more portable, making it last longer, and ensuring that they get the amount ("flow rate") that is needed. To address these issues, the NHLBI is sponsoring the Air You Wear Challenge - a two phase challenge with a total prize purse of $500,000 to help teams with compelling ideas to develop and demonstrate proof of concept for their innovative approaches for providing supplemental oxygen to outpatients, while promoting activity in the field and awareness of this problem to the wider community. Proposed approaches can be for new devices, modifications to existing technologies, or something else entirely.

Advancement of Agency Mission: The general purpose of the NHLBI is the conduct and support of research, training, health information dissemination, and other programs with respect to heart, blood vessel, lung, and blood diseases and with respect to the use of blood and blood products and the management of blood resources (42 U.S.C. 285b). The mission of the NHLBI is to promote the prevention and treatment of heart, lung, and blood diseases and enhance the health of all individuals so that they can live longer and more fulfilling lives. In order to fulfill its mission, the NHLBI stimulates basic discoveries about the causes of disease, enables the translation of basic discoveries into clinical practice, fosters training and mentoring of emerging scientists and physicians, and communicates research advances to the public. The NHLBI Strategic Vision specifically encompasses an objective to develop and optimize novel diagnostic and therapeutic strategies to prevent, treat, and cure heart,

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[75] The website for The Air you Wear Challenge is accessible at https://www.nhlbi.nih.gov/grants-and-training/air-you-wear-challenge ; https://www.challenge.gov/?challenge=air-you-wear-challenge.

lung, blood, and sleep diseases. In line with these authorities, this Challenge will lead to innovation in outpatient supplemental oxygen use.

Plan for Upcoming Two Fiscal Years: NIH will continue to evaluate and identify the best opportunities to use challenges and prize competitions to spark new ways of thinking, solve tough problems, stimulate innovation, and advance its core mission of turning discovery into health.

A.4. Department of Transportation (DOT)

A.4.1. Inclusive Design Challenge[76]

Sponsoring Agency and Office: Office of the Secretary

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Inclusive Design Challenge sought innovative design solutions to enable people with physical, sensory, and cognitive disabilities to use automated vehicles to access jobs, healthcare, and other critical destinations. The Challenge sought hardware and software solutions to improve passenger vehicle accessibility, encourage cross-disciplinary collaborations, incentivize development of new designs and technologies, and tap into the creativity and knowledge of the disability community, researchers, advocates, and entrepreneurs.

Advancement of Agency Mission: The Inclusive Design Challenge has advanced the Department's equity and transformation strategic goals. The Inclusive Design Challenge lays the foundation for several follow-up actions related to these priority goal areas.

Plan for Upcoming Two Fiscal Years: The Inclusive Design Challenge has informed the development of additional prize competitions within DOT. Following the success of its Inclusive Design Challenge, DOT is using a Challenge prize-competition format for other topics to support the Administration's priority areas.

A.5. Department of the Energy (DOE)

A.5.1. American-Made Perovskite Startup Prize[77]

Sponsoring Agency and Office: Solar Energy Technologies Office

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The American-Made Perovskite Startup Prize is a $3 million prize competition designed to accelerate the growth of the U.S. perovskite industry and support the rapid development of solar cells and modules that use perovskite materials. Through two contests, established perovskite researchers will launch a company and move toward commercialization in under a year. The Perovskite Startup Prize consists of two consecutive contests that accelerate efforts to develop new, innovative perovskite solar companies with the potential to manufacture commercially viable products in the U.S.

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[76] The website for Inclusive Design Challenge is accessible at https://www.transportation.gov/accessibility/inclusivedesign.

[77] The website for American-Made Perovskite Startup Prize is accessible at https://www.herox.com/perovskiteprize https://www.energy.gov/eere/solar/american-made-challenges-perovskite-startup-prize https://americanmadechallenges.org/challenges/perovskiteprize/index.html.

The best-performing competitors in the Countdown Contest are awarded cash prizes and are eligible to compete in the Liftoff Contest. These cycles of contests repeat until a certain number of winners are selected (4-8 for Countdown, 2-3 for Liftoff).

Advancement of Agency Mission: The Perovskite Startup Prize has funded multiple competitors with strong academic research backgrounds that recently launched businesses to commercialize their innovative perovskite technologies. This is in support of the Solar Energy Technologies Office's goals of accelerating the development and deployment of solar technologies, spurring solar manufacturing, and creating domestic jobs and opportunities through public-private partnerships.

Plan for Upcoming Two Fiscal Years: The Perovskite Startup Prize will continue into FY23 and FY24. The final deadline for the first phase of the competition (Countdown) occurred on March 23, 2023 and selections were announced at the Materials Research Society (MRS) Spring Meeting in San Francisco on April 11, 2023. The second phase of the competition (Liftoff) will remain open in FY23 and FY24. The program is expected to close in FY24.

A.5.2. American-Made Solar Prize[78]

Sponsoring Agency and Office: SETO

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Solar Prize encourages the rapid development of innovative solar energy solutions capable of addressing the tough challenges facing the solar industry. Solar Prize competitors participate in three contests—the Ready!, Set!, and Go! Contests—to transform their ideas into reality in months, rather than years. Competitors have the chance to win part of $4.1 million in cash prizes and technical support vouchers to help them advance in the competition and accelerate the development of their solution. The Solar Prize includes an optional additional challenge that focuses on advancing solar in underserved communities. Participants who choose to incorporate this initiative into their solutions have the chance to be considered for a Justice, Equity, Diversity, and Inclusion (JEDI) Contest and earn part of the $200,000 bonus cash prize.

Advancement of Agency Mission: The Solar Prize supports the Administration's work to spur solar manufacturing, develop innovative solar solutions and products, and create domestic jobs and opportunities through public-private partnerships. The prize model disrupts traditional thinking, and introduces, expands, and evolves what's possible for federal agencies. Prize competitions increase the number of perspectives working to solve difficult problems, foster interdisciplinary collaboration, remove barriers to participation, and make innovation easy, fast, and agile.

Plan for Upcoming Two Fiscal Years: The Department of Energy plans to continue funding additional rounds of the American-Made Solar Prize in FY23 and FY24. For FY23, Round 6 of the Solar Prize is already underway with 20 teams announced as semifinalists at the beginning of December 2022. The Round 6 competition will conclude by the end of FY23, and we plan to launch Round 7 pending future appropriations. In FY24, it is expected that Round 7 would complete on a similar timeline to Round 6, and we would consider launching Round 8 pending appropriations and continued high impact from the program.

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[78] The website for American-Made Solar Prize is accessible at https://americanmadechallenges.org/challenges/solarprize/round6/ https://www.herox.com/solarprizeround6 https://www.energy.gov/eere/solar/american-made-solar-prize.

A.5.3. CABLE Prize[79]

Sponsoring Agency and Office: Advanced Materials and Manufacturing Technologies Office

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Conductivity-enhanced materials for Affordable, Breakthrough Leapfrog Electric and thermal applications (CABLE) Conductor Manufacturing Prize ("prize") will award a total of up to $4.5 million in cash prizes and vouchers for testing and technical assistance to competitors. As electrification grows worldwide, so too will demand grow for affordable conductivity-enhanced materials and applications—especially those with same or increased enhancement at elevated industrial process temperatures. Hence, there is a need to rapidly transition such conductivity-enhanced materials— in advanced cables as well as in anything else that uses electricity—from the lab to the marketplace. Conductivity-enhanced materials support transformational technologies, such as electric cars and planes, as well as more advanced versions of everyday technologies, including smartphones, heat pumps, and motors. For all these reasons, the U.S. Department of Energy (DOE) Advanced Materials and Manufacturing Technology Office (AMMTO) launched the CABLE Conductor Manufacturing Prize to help supercharge the U.S. energy and manufacturing industries. In addition to their benefits for clean energy technologies, conductivity-enhanced materials can deliver a clean energy future by enabling affordable, cleaner, lower-impact grid expansion that ensures environmental justice and inclusion of disadvantaged communities. The competitive activities supported by this prize will enhance the governmentwide approach to the climate crisis. The prize aims to identify, verify, and reward breakthrough materials and manufacturing methods that have the potential to affordably exceed the electrical conductor enhancement thresholds. In particular, competitors must document a pathway to produce their new conductivity-enhanced material so that it is economically competitive with today's leading conductors in applications that enable innovators to "leapfrog" current state-of-the-art technology.

Advancement of Agency Mission: AMMTO will use the results of the CABLE Manufacturing prize to inform future program initiatives related to advanced manufacturing of enhanced conductivity materials as well as to further research efforts related to electrification and decarbonization.

Plan for Upcoming Two Fiscal Years: The U.S. Department of Energy, Advanced Materials and Manufacturing Technology Office is interested in additional prize program opportunities, and both AMMTO and IEDO are planning Prizes in FY23 and FY24.

A.5.4. Community Clean Energy Coalition Prize[80]

Sponsoring Agency and Office: Multiple (VTO, BETO, HFTO, WETO, GTO, REGI, BTO, and AMO)

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The goal of the Community Clean Energy Coalition Prize is to encourage community coalitions—made up of nonprofits, city governments, school systems, and other community organizations—to come together to develop a strategy to address a local clean energy opportunities or inequities. Strategies include student education, workforce trainings, or the

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[79] The website for CABLE Prize is accessible at https://www.herox.com/cable.
[80] The website for Community Clean Energy Coalition Prize is accessible at https://www.herox.com/CleanEnergyCoalition/entries.

implementation of new technologies that align with the goals of the White House's Justice40 Initiative. The first phase will issue up to 10 $30,000 prizes for describing the members and needs of the coalition, the community to be served, and the clean energy issue to be addressed. Winners of that phase will be eligible for phase two, which has up to 10 prizes of $115,000 each. Applicants will submit a Coalition Implementation Plan that articulates the approach and specific steps for achieving their mission and advancing the DOE Justice40 policy priorities. The phase two applications will be evaluated on the extent to which their Coalition Implementation Plan specifies actionable steps that are likely to impact the identified community, addresses the defined energy challenge, and advances the relevant DOE Justice40 policy priorities. The final phase of the prize competition will be open to all phase one winners. Phase three will offer a $50,000 grand prize based on the demonstrated execution of the Coalition Implementation Plan developed in phase two and the measured impact to date.

Advancement of Agency Mission: This prize allows participants to address a wide range of potential energy challenges as well as focus on community needs. This prize will serve as the starting point for further exploration, analysis, and discussion within EERE and demonstrate EERE's commitment to Justice40 priorities. The benefit of bringing community organizations together to address energy system challenges, whether they be related to specific technology developments or to broader energy system challenges, is to enable a stronger community voice and improve community input into energy system decisions. The prize will enable lessons learned and best practices to be shared with other communities as well.

Plan for Upcoming Two Fiscal Years: The intent is to fund related prizes in FY24 and beyond, dependent on participation.

A.5.5. E-Robot Prize[81]

Sponsoring Agency and Office: Office of Energy Efficiency & Renewable Energy

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The American-Made Envelope Retrofit Opportunities for Building Optimization Technologies (E-ROBOT) Prize focused on developing advanced robotics for building envelope retrofits in alignment with the Advanced Building Construction (ABC) Initiative. Advancements in robotics capabilities and controls allow for workers to reach places and perform activities that were previously difficult to access or unsafe. For example, robots can safely enter small spaces and cavities, such as ductwork, to perform air-sealing or other efficiency activities. Robots can complement and support the existing workforce by creating new employment and business opportunities while also helping to ensure quality and consistency when installing energy efficiency measures. The E-ROBOT Prize incentivizes research and development to improve the energy efficiency of residential and commercial buildings as well as open new opportunities for the buildings and construction workforce without sacrificing the comfort of occupants. The E-ROBOT Prize provided a total of $5 million in funding, including $4 million in cash prizes for competitors and an additional $1 million in awards and support to network partners.

Advancement of Agency Mission: The strategic connection is to make homes more efficient and to reach areas that are too unsafe or impossible to reach with traditional approaches. Reduce costs and to bring in automation and robotics advances from other industries to buildings.

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[81] The website for E-Robot Prize is accessible at https://www.herox.com/EROBOT.

Plan for Upcoming Two Fiscal Years: There was substantial interest in continuing work around the topics covered by this prize. Plan being formulated on how to proceed.

A.5.6. Energy Program for Innovation Clusters (EPIC) Prize Round 2[82]

Sponsoring Agency and Office: Office of Technology Transitions

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: DOE's Office of Technology Transitions (OTT) launched the American-Made EPIC Prize Round 2. OTT developed EPIC to encourage robust growth of regional energy innovation ecosystems across the United States. Innovation ecosystems, or clusters, increase the productivity of start-ups, drive the direction and pace of innovation, and stimulate the formation of new businesses, further reinforcing the cluster itself. The $4.5 million competition awarded cash prizes to regional incubators that implemented high-impact ideas to support energy startups and entrepreneurs. Core to the EPIC Prize Round 2 is the incubator program, which consists of three phases: first, design a plan to support energy startups and entrepreneurs; second, implement the innovative, place-based plan; and third, demonstrate success. OTT also partnered with other DOE program offices to provide Bonus Prizes for incubators supporting a specific technology area. The program also included a pitch competition, in which incubators nominate energy start-ups for a chance to win up to $50,000. Through this prize, OTT welcomed incubator organizations that aid in the development of new business ventures, business accelerators, co-working start-up communities, or any other organizations that self-identify as advocates for innovation and entrepreneurship to compete in EPIC. All competitors were required to address the program requirements to create new programming, support start-up creation, build regional partnerships, and support least one of the following: diversity, equity, and inclusion; rural and disadvantaged communities; lab-to-market; sector-specific support; or another high-impact theme.

Advancement of Agency Mission: In 2015, the Secretary of Energy authorized the formation of OTT to be responsible for developing and overseeing delivery of DOE's strategic vision and goals for technology commercialization and engagement with the business and industrial sectors across the United States. OTT's mission is to expand the commercial impact and public benefit of DOE's research and development portfolio to advance the economic, energy, and national security interests of the Nation. To support the agency's mission, the EPIC Prize seeks to address a capital gap to support organizations advancing early stage energy entrepreneurs, encourage organizations to think more expansively about their role in the broader regional and national innovation and entrepreneurial ecosystem, enable winners of this prize to enhance their organization's resilience and operational sustainability, and in general to support the national advancement of energy entrepreneurship and commercialization.

Plan for Upcoming Two Fiscal Years: EPIC Prize Round 2 is a 3-phase prize that will continue through FY23.

A.5.7. EnergyTech UP[83]

Sponsoring Agency and Office: Office of Technology Transitions

Authority: America COMPETES Reauthorization Act of 2010

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[82] The website for EPIC Prize Round 2 is accessible at https://americanmadechallenges.org/challenges/epic/.

[83] The website for EnergyTech UP is accessible at https://www.energy.gov/technologytransitions/energytech-university-prize and https://www.herox.com/EnergyTechUP.

Competition Summary: Sponsored by the Office of Technology Transitions (OTT) at DOE, the EnergyTech University Prize (EnergyTech UP) is a collegiate competition challenging multidisciplinary student teams to develop and present a business plan that leverages DOE national laboratory-developed and other high-potential energy technologies. EnergyTech UP, in partnership with American-Made Challenges, is designed to be approachable, equitable, and scalable nationwide. Distinct from many other startup competitions, winners will be chosen on the strength of their business plans rather than their ability to start a business. Student teams compete for over $250,000 in cash prizes as they develop business proposals involving lab-developed or other high-potential energy technologies, assess commercialization opportunities through market analysis, and present a viable business plan to industry judges. Throughout the competition, they receive mentorship and materials to help them succeed. The top three teams will compete for a share of the total prizes funded by OTT. In addition, nine DOE Technology Offices, including the OTT, are offering $25,000 each in bonus prizes for the best teams in their respective fields. Understanding that energy is often inherently local, teams first present at their regional events. The first edition of EnergyTech UP concluded in March 2022. In total, 180 teams from 113 distinct collegiate institutions participated. 11 teams were recognized as regional winners, 6 teams were recognized as technology bonus prize winners, and 3rd, 2nd, and 1st place were awarded.

Advancement of Agency Mission: This prize is primarily sponsored by DOE's OTT. DOE's primary mission is to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions. These solutions have given rise to a diverse range of technologies, from the superconducting magnets that enabled Magnetic Resonance Imaging (MRI) to the battery cathodes that are used in today's plug-in electric vehicles. World-changing innovations like these become possible only by transitioning technology out of the laboratory and into the commercial sphere. But it's almost never easy—so in 2015, the Secretary of Energy authorized the formation of OTT, and in 2020, Congress formalized its establishment. OTT serves as the steward of DOE's Research, Development, Demonstration and Deployment (RDD&D) continuum and is sponsoring this prize to aid technologies in their progression to commercialization. EnergyTech UP supports this mission through the development of relationships with schools and students, the creation of new ideas, and the opportunity to create new businesses.

Plan for Upcoming Two Fiscal Years: The respondent cannot comment on the full plans for DOE. OTT has interest in further supporting EnergyTech UP. The CHIPS Act indicated interest in continued pursuit of prizes by OTT for the next several years. EnergyTech UP has been announced for FY23.

A.5.8. FAST Commissioning for Pumped-Storage Hydropower Prize[84]

Sponsoring Agency and Office: Office of Energy Efficiency and Renewable Energy

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Pumped Storage Hydropower (PSH) FAST Commissioning Prize aimed to reduce the time, cost, and risk required to commission PSH projects by crowdsourcing ideas via a three-stage prize. Objectives were to reduce the time to commission PSH projects from 10+ years to less than 5 years and to develop a baseline analysis for PSH.

Advancement of Agency Mission: The U.S. has 43 pumped storage hydropower facilities, making up 93% of the country's utility-scale energy storage. Still, more could come thanks to advancements in that

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[84] The website for FAST Commissioning for Pumped-Storage Hydropower Prize is accessible at https://americanmadechallenges.org/challenges/fast/index.html.

technology — the winners of the FAST Prize are developing innovations to push pumped storage hydropower to the next level.

Plan for Upcoming Two Fiscal Years: None reported

A.5.9. FLOWIN Prize[85]

Sponsoring Agency and Office: Wind Energy Technologies Office (WETO) within EERE

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: This $5.75 million prize was launched by the DOE Wind Energy Technologies Office (WETO) to pave the way for the cost-effective domestic manufacturing and deployment of commercial utility-scale floating offshore wind energy turbines in U.S. waters. WETO's first-ever prize, the FLOWIN Prize, supports the Biden administration's goal to decarbonize the U.S. electricity grid by 2035 and achieve a net zero economy by 2050. In addition, the prize aims to further the principles of inclusion and environmental justice embodied in the administration's Justice40 Initiative by requiring competitors to indicate how their long-range manufacturing and supply chain development plans can benefit disadvantaged and underserved communities.

Advancement of Agency Mission: This prize advances agency missions by lowering barriers for commercial entities to work with the government, increasing the speed of R&D, and allowing useful investment of modest sums of money.

Plan for Upcoming Two Fiscal Years: WETO is investigating two additional prize concepts.

A.5.10.   Fish Protection Prize[86]

Sponsoring Agency and Office: Office of Energy Efficiency & Renewable Energy

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The U.S. Department of Energy (DOE) Water Power Technologies Office (WPTO), in collaboration with the U.S. Bureau of Reclamation, launched the Fish Protection Prize to inspire innovators to compete for $700,000 of combined cash prizes and voucher support to help protect fish from these threats. In September 2020, three teams were selected as Grand Prize winners, and now these teams will work alongside researchers at the Pacific Northwest National Laboratory to advance their solutions.

Advancement of Agency Mission: WPTO seeks to address R&D challenges for modernization of hydropower. This prize helped to advance R&D in coordination with the Bureau of Reclamation to advance fish passage solutions, a critical environmental and R&D challenge for the hydropower industry.

Plan for Upcoming Two Fiscal Years: None reported

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[85] The website for FLOWIN Prize is accessible at https://www.herox.com/FLOWIN.
[86]   The   website   for   Fish   Protection   Prize   is   accessible   at https://americanmadechallenges.org/challenges/fishprotection/index.html.

A.5.11.   Geothermal Geophone Prize[87]

Sponsoring Agency and Office: Energy Efficiency and Renewable Energy

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Spearheaded by the Geothermal Technologies Office within the Office of Energy Efficiency and Renewable Energy at DOE, and in partnership with the National Renewable Energy Laboratory and Lawrence Berkeley National Laboratory, the Geophone Prize spurs creativity and addresses the challenges of operating seismic sensors in geothermal environments. The American-Made High Temperature Geothermal Geophone Prize is designed to catalyze the development of high temperature, downhole capable seismic monitoring for enhanced geothermal systems (EGS) in the American instrumentation community. This is accomplished through a series of prize competitions and the development of a diverse and powerful support network that leverages national laboratories, energy incubators, and other resources from across the United States.

Advancement of Agency Mission: Resulting designs will be field tested in active geothermal environments to allow for higher resolution data collection than has been possible in the past. These data will improve our understanding of EGS and hydrothermal systems.

Plan for Upcoming Two Fiscal Years: N/A

A.5.12.   Geothermal Manufacturing Prize[88]

Sponsoring Agency and Office: Energy Programs - Geothermal Technologies Office

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The American-Made Geothermal Manufacturing Prize (Geothermal Prize) is designed to spur innovation and address manufacturing challenges fundamental to operating in harsh geothermal environments. This prize further supports the ability of the geothermal industry to reach the target of 60 GWe of geothermal capacity by 2050 as outlined in the recently released GeoVision study. As part of the American-Made Challenges series, the Geothermal Prize unites the world's best-in-class research base with the unparalleled entrepreneurial support system of the American-Made Network. Consisting of pioneering maker spaces, dozens of energy incubators, universities, and 17 DOE National Laboratories, the Network is primed to create a sweeping portfolio of innovations to demonstrate the promise of additive manufacturing. Competitors in the Ready!, Set!, Make!, and Geo! Contests participate in four escalating challenges. The contests provide a total of $4.65 million in incentives—$3.25 million in cash prizes, $1 million in vouchers, and $400,000 in field testing costs—to incentivize driving additively manufactured geothermal innovations from concept to prototype testing in two years through an accelerated schedule.

Advancement of Agency Mission: As part of the Geothermal Technologies Office Multi-Year Program Plan, subsurface accessibility is a primary area of research for FY22-FY26. "Enabling technologies—from electronics to elastomers that can survive harsh conditions—are fundamental to addressing the environment associated with geothermal drilling. Technologies that perform in high-temperature, high-pressure, high-shock, corrosive environments are required for a wide range of downhole tools

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[87] The website for Geothermal Geophone Prize is accessible at https://www.herox.com/GeophonePrize.
[88] The website for Geothermal Manufacturing Prize is accessible at https://americanmadechallenges.org/challenges/geothermalmanufacturing/index.html.

needed for drilling, logging, and monitoring of geothermal wells. Additionally, consumables such as lost-circulation." The purpose of this competition was for competitors to design components using additive manufacturing to address the problems that are faced in harsh, corrosive, high-temperature environments. Participants in this Prize Program have already gone on to work under different geothermal-related prize programs and research activities.

Plan for Upcoming Two Fiscal Years: There is another ongoing competition within the Geothermal Technologies Office: the American-Made Geothermal Geophone Prize. The competition "is designed to catalyze the development of high-temperature, downhole capable seismic monitoring for enhanced geothermal systems." Phase 1 has been completed, with the semifinalists being announced on Dec. 2nd, 2022 (FY23, Q1). Phase 2 finalists will be announced on December 1st, 2023 (FY24, Q1). The last phase of the competition will continue through FY25. Planning underway for future competitions.

A.5.13. Groundbreaking Hydro Prize[89]

Sponsoring Agency and Office: Office of Energy Efficiency and Renewable Energy

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The U.S. Department of Energy (DOE) Water Power Technologies Office (WPTO) launched the Groundbreaking Hydro Prize to encourage the development of new ideas to cut the costs, timelines, and risks associated with hydropower development. This competition challenged innovators to come up with new solutions to support hydropower project development by starting at square one—the foundation.

Advancement of Agency Mission: Geotechnical solutions to address hydropower development is a key impediment for new hydropower development. By soliciting new ideas for building new dams, this prize sought to incentivize new ideas for development of new hydropower through new geotechnical solutions.

Plan for Upcoming Two Fiscal Years: None reported

A.5.14. H-Prize: Hydrogen Shot Incubator[90]

Sponsoring Agency and Office: Under Secretary for Science

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: This $2.6-million prize was launched by the DOE Hydrogen and Fuel Cell Technologies Office to identify, develop, and test disruptive technologies to reduce the cost of clean hydrogen production. This prize supports the goal of DOE's Hydrogen Program and the Hydrogen Energy Earthshot to enable the production of clean hydrogen for $1 per 1 kilogram in 1 decade ("1 1 1").

Advancement of Agency Mission: This prize solicited concepts for clean hydrogen production that are unique and innovative as compared to the currently funded work on hydrogen production through DOE. The Hydrogen and Fuel Cell Technologies Office funds hydrogen production research over a broad scope of technologies including electrolysis, reforming, pyrolysis, thermochemical, and biological. The

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[89] The website for Groundbreaking Hydro Prize is accessible at https://americanmadechallenges.org/challenges/groundbreakinghydro/.

[90] The website for H-Prize: Hydrogen Shot Incubator is accessible at https://www.herox.com/HydrogenShotPrize.

prize supports clean energy technology development, one of the missions of the Office of Energy Efficiency and Renewable Energy.

Plan for Upcoming Two Fiscal Years: The Hydrogen Shot Incubator Prize will extend through FY25. The Phase 1 and 2 prize winners will be announced in FY23 and the prize will culminate in FY25 with an opportunity for participants to publicly present their work.

A.5.15.   I AM Hydro Prize[91]

Sponsoring Agency and Office: Office of Energy Efficiency & Renewable Energy

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Advanced manufacturing technologies are revolutionizing the way products are designed and built across countless industries. And while the benefits of advanced manufacturing are well-understood, the high-impact opportunities for incorporating it into hydropower have yet to be tapped. The I AM Hydro Prize sought innovative solutions to strengthen hydropower by applying advanced manufacturing technologies to reduce construction costs and repair frequency, improve efficiency and energy capture, and more.

Advancement of Agency Mission: Advanced manufacturing for hydropower can address challenges to modernizing hydropower. This prize helped DOE to identify new and promising solutions for advanced manufacturing applied to an incumbent industry, helping to build out a roadmap for future R&D solutions for hydropower.

Plan for Upcoming Two Fiscal Years: None reported

A.5.16.   Inclusive Energy Innovation Prize[92]

Sponsoring Agency and Office: Under Secretary for Energy

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Disadvantaged communities have experienced—and still experience—the negative impacts of climate change, global warming, and pollution at higher rates than the general population. The U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) and the Office of Economic Impact and Diversity (ED) recognize that improvements are needed to make the clean energy innovation ecosystem more inclusive and accessible to disadvantaged communities and individuals from groups historically underrepresented in science, technology, engineering, and mathematics (STEM). Now, as the nation invests in more clean energy technology, DOE has a responsibility to prioritize serving these too-often-overlooked communities. The Inclusive Energy Innovation Prize fits into the Biden's Administration's Justice40 Initiative, which aims to deliver 40% of climate investment benefits to disadvantaged communities and inform equitable research, development, and deployment within DOE.

Advancement of Agency Mission: It is expected that Phase One prizes will enable the winning organizations to fund proposed programs for approximately one full-time-equivalent person and carry out related activities that may include actively engaging with disadvantaged communities in their

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[91] The website for I AM Hydro Prize is accessible at https://americanmadechallenges.org/challenges/iamhydro/.
[92]   The   website   for   Inclusive   Energy   Innovation   Prize   is   accessible   at https://americanmadechallenges.org/challenges/inclusiveenergyinnovation/index.html.

regions, building relationships through workshops and other events, providing technical support, and facilitating connections with technical expertise and academic institutions. DOE seeks to support and recognize clean energy grassroots innovation related to technology advancement from disciplines beyond science and engineering, which accelerate climate and clean energy technology development and adoption with a focused impact on disadvantaged communities.

Plan for Upcoming Two Fiscal Years: This prize will continue into FY23.

A.5.17. L-Prize[93]

Sponsoring Agency and Office: Office of Energy Efficiency & Renewable Energy

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Lighting Prize (L-Prize) is designed to advance the U.S. clean energy economy for next-generation LED lighting, encouraging innovators to engage in advanced lighting system development that leads to transformative designs, products, and impact. The L-Prize will reward innovations that move rapidly to improve lighting performance, resulting in energy, emissions, and cost savings for American businesses and consumers. The competition will award a total of $12.2 million in cash prizes across three distinct phases: Concept, Prototype, and Manufacturing and Installation. Advanced interoperable lighting systems have the potential to better manage lighting energy use, integrate with other building systems, streamline maintenance and operations, and even respond to electric grid signals, increasing the value and resiliency of buildings. The L-Prize seeks to unlock the additional potential to combine high-luminaire efficacy with exceptional lighting quality, data-driven control and functionality, and sustainable design and construction for the future of illumination in commercial and institutional buildings. In addition to these technical innovations, the L-Prize also prioritizes diversity, equity, and inclusion in how luminaires or lighting systems can benefit communities that have been historically disadvantaged. The L-Prize targets commercial sector lighting, which accounts for about 36% of national lighting energy use and encourages lighting innovators to design lighting systems with breakthrough energy efficiency, quality, functionality, and sustainability. A full realization of the solid-state lighting technology potential envisions LED lighting products manufactured with significant domestic materials, while demonstrating exceptional energy efficiency, data connectivity, control capabilities, visual quality, and design for recycling and remanufacturing.

Advancement of Agency Mission: Commercial sector lighting, which accounts for about 36% of national lighting energy use and the prize encourages lighting innovators to design lighting systems with breakthrough energy efficiency, quality, functionality, and sustainability.

Plan for Upcoming Two Fiscal Years: We plan on continuing to use prize competitions to advance our mission and goals.

A.5.18. Ocean Observing Prize[94]

Sponsoring Agency and Office: Under Secretary for Energy

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[93] The website for L-Prize is accessible at https://americanmadechallenges.org/challenges/lprize https://www.herox.com/LPrize.

[94] The website for Ocean Observing Prize is accessible at https://americanmadechallenges.org/challenges/oceanobserving/index.html.

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Ocean Observing Prize competitors were tasked with developing concepts that integrated marine renewable energy with ocean observing systems, such as weather buoys, autonomous underwater vehicles (AUVs), meteorological-oceanographic (metoc) buoys, ocean observing cabled arrays, and more. These marine-energy-powered devices will effectively cut the charging cord, enabling longer deployments at sea, resulting in better data capture and a better understanding of our oceans. The Ocean Observing Prize consists of two competitions designed to accelerate innovation in marine energy and ocean observation. The first competition, the DISCOVER Competition, solicited novel concepts that integrated ocean observing technologies with marine energy systems. The second competition, the DEVELOP Competition, focused exclusively on the theme of hurricane monitoring. The challenge theme may vary in future iterations of the prize.

Advancement of Agency Mission: The Powering the Blue Economy™: Ocean Observing Prize challenged innovators to integrate marine renewable energy with ocean observation platforms, ultimately revolutionizing our ability to collect the data needed to understand, map, and monitor the ocean. A joint endeavor of the U.S. Department of Energy's (DOE's) Water Power Technologies Office (WPTO) and the Integrated Ocean Observing System (IOOS®) program at the National Oceanic and Atmospheric Administration (NOAA), the Ocean Observing Prize included a series of competitions, with millions of dollars in awards, to encourage rapid innovation in the fields of marine energy and ocean observations.

Plan for Upcoming Two Fiscal Years: The final competition of the prize will end in Q1 of FY24. A second iteration of the prize is currently being scoped and is currently anticipated to be announced around the same time.

A.5.19.   SMART Visualization Prize Challenge Phase 2[95]

Sponsoring Agency and Office: Office of Fossil Energy and Carbon Management

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The U.S. Department of Energy's (DOE's) Office of Fossil Energy and Carbon Management (FECM) "Science-informed Machine Learning to Accelerate Real Time Decisions in the Subsurface" (SMART) Visualization Platform (VP) Challenge prize competition aims to develop an intuitive data visualization tool for the subsurface environment that can be readily accessible by scientists, engineers, subsurface operators, and decision makers. Competitors are asked to focus on bringing the subsurface to life through the development of an innovative, user-friendly, intuitive, and attractive visualization platform.

Advancement of Agency Mission: The end product of the challenge, a visualization platform, can be used to engage and inform external entities in a meaningful way about decisions and research in the subsurface. The platform will also serve the broader SMART initiative as a way to visualize the output of new workflows developed to understand subsurface data.

Plan for Upcoming Two Fiscal Years: This prize challenge completed its second and final phase in August of 2022.

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[95]   The website for SMART Visualization Prize Challenge Phase 2 is accessible at https://netl.doe.gov/challenges/SMARTVisualizationPlatform.

A.5.20.   Solar APP+[96]

Sponsoring Agency and Office: Solar Energy Technologies Office

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Solar energy currently accounts for about 3% of U.S. electricity. To combat climate change, the nation's solar capacity will likely need to grow by hundreds of gigawatts in the next 15 years, resulting in millions of residential solar projects nationwide requiring building permits. Solar permitting can be a major bottleneck for residential solar installations due to long review timelines or unclear processes that might require revised permit applications. These factors making it challenging for local governments to efficiently approve a growing number of building-permit applications for residential solar systems. Solar Automated Permit Processing Plus (SolarAPP+) eases the permitting process, making it easier for homeowners across the United States to power their homes from the sun while saving time for local governments and installers. SolarAPP+ is a software tool developed by the National Renewable Energy Laboratory (NREL) that enables instant online permitting for code-compliant residential rooftop solar systems. Local governments that have adopted the SolarAPP+ have saved thousands of hours in plan review time so far. Furthermore, projects have been installed about two weeks faster, given that permits are issued instantly for code-compliant systems. Although SolarAPP+ is free for local governments to adopt, there are associated costs that arise during the adoption process. The SolarAPP+ Prize was created to ease the burden of these costs for communities and to accelerate the adoption of SolarAPP+. It is a two-step competition that will award up to $1 million to incentivize communities to accelerate their adoption of SolarAPP+. NREL manages the prize program. Communities that are selected for the SolarAPP+ Prize (Step 1) and implement SolarAPP+ (Step 2) by April 27, 2023 are eligible to receive $15,000.

Advancement of Agency Mission: The DOE Solar Energy Technologies Office accelerates the advancement and deployment of solar technology in support of an equitable transition to a decarbonized economy no later than 2050, starting with a decarbonized power sector by 2035. SolarAPP+ aims to reduce the soft costs of installing a residential solar system by streamlining permitting processes. For homeowners looking to go solar, a streamlined permitting process means faster installation of their rooftop systems. Researchers found that SolarAPP+ shortens total project timelines by nearly two weeks. Shorter project timelines mean consumers can start generating solar energy and benefiting from lower utility bills even faster. With SolarAPP+, local governments, installers, and consumers all reap the benefits, helping more Americans access the cost-saving benefits of solar energy and accelerating the clean energy transition.

Plan for Upcoming Two Fiscal Years: N/A

A.5.21.   Solar Decathlon 2021 Design Challenge[97]

Sponsoring Agency and Office: Building Technologies Office

Authority: America COMPETES Reauthorization Act of 2010

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[96] The website for Solar APP+ is accessible at https://solarapp.nrel.gov/; https://www.herox.com/SolarApp;.
[97]   The   website   for   Solar   Decathlon   2021   Design   Challenge   is   accessible   at https://www.solardecathlon.gov/event/challenges-design.html.

Competition Summary: The U.S. Department of Energy Solar Decathlon® Design Challenge is an annual, design-only collegiate competition focused on high-performance buildings that develops the next generation of buildings professionals, researchers, and innovators. Collegiate students competing in the Design Challenge work in multidisciplinary teams to create zero energy, high-performance building designs. Teams collaborate on a residential or commercial design project for one or two academic semesters, with the competition culminating each April at the Solar Decathlon Competition Event with hundreds of students in attendance. The Competition Event provides an opportunity for teams to present their designs to expert jurors, network and build connections with industry professionals, and share ideas with other Decathletes from around the world. Winning designs and teams are promoted by the U.S. Department of Energy through a variety of means, including press releases, conference presentations, and social media campaigns, to tackle climate change by expanding awareness of zero energy design to the general public.

Advancement of Agency Mission: The Design Challenge advances workforce development in the buildings industry by preparing future professionals to design and construct high-performance buildings. As buildings account for 74% of electricity use and 39% of total energy use, the path to a renewable energy future goes straight through the nation's buildings. Through industry partnerships, teams are also encouraging the industry to advance towards zero energy designs at a faster pace.

Plan for Upcoming Two Fiscal Years: The Building Technologies Office will continue the Solar Decathlon Design Challenge in FY23 and expects to fund the program in FY24.

A.5.22.   Solar Decathlon 2022 Design Challenge[98]

Sponsoring Agency and Office: Building Technologies Office

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The U.S. Department of Energy Solar Decathlon® Design Challenge is an annual, design-only collegiate competition focused on high-performance buildings that develops the next generation of buildings professionals, researchers, and innovators. Collegiate students competing in the Design Challenge work in multidisciplinary teams to create zero energy, high-performance building designs. Teams collaborate on a residential or commercial design project for one or two academic semesters, with the competition culminating each April at the Solar Decathlon Competition Event with hundreds of students in attendance. The Competition Event provides an opportunity for teams to present their designs to expert jurors, network and build connections with industry professionals, and share ideas with other Decathletes from around the world. Winning designs and teams are promoted by the U.S. Department of Energy through a variety of means, including press releases, conference presentations, and social media campaigns, to tackle climate change by expanding awareness of zero energy design to the general public.

Advancement of Agency Mission: The Design Challenge advances workforce development in the buildings industry by preparing future professionals to design and construct high-performance buildings. As buildings account for 74% of electricity use and 39% of total energy use, the path to a renewable energy future goes straight through the nation's buildings. Through industry partnerships, teams are also encouraging the industry to advance towards zero energy designs at a faster pace.

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[98]   The website for Solar Decathlon 2022 Design Challenge is accessible at https://www.solardecathlon.gov/event/challenges-design.html.

Plan for Upcoming Two Fiscal Years: The Building Technologies Office will continue the Solar Decathlon Design Challenge in FY23 and expects to fund the program in FY24.

A.5.23. Solar Decathlon 2023 Build Challenge[99]

Sponsoring Agency and Office: Under Secretary for Science

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The DOE Solar Decathlon® Build Challenge is a two-year collegiate competition where teams design, build, and operate zero-energy, high-performance residential buildings in their local communities. Teams of students collaborate with local industry stakeholders to execute the design and construction, demonstrating creative solutions for real-world issues in the built environment. The hands-on challenge culminates in the evaluation of the finished project at the Solar Decathlon Competition Event. Evaluation considers measured performance of the completed house, as well as team presentations to juries of industry experts to showcase the excellence of their solutions. Teams offer tours of the completed homes to their local communities, promoting high-performance building techniques to the general public. Winners are publicized through a variety of media outreach efforts, providing participants and collegiate institutions with an opportunity for national exposure.

Advancement of Agency Mission: The Solar Decathlon advances workforce development in the buildings industry by preparing future professionals to design and construct high-performance buildings. Through industry partnerships, teams are also encouraging industry to advance towards zero energy designs at a faster pace.

Plan for Upcoming Two Fiscal Years: The Building Technologies Office will continue funding the Build Challenge in FY23 and FY24 in preparation for the 2025 Build Challenge.

A.5.24. Solar Decathlon 2023 Design Challenge[100]

Sponsoring Agency and Office: Buildings Technology Office

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The DOE Solar Decathlon® Design Challenge is a two-semester collegiate competition where teams design high-performance buildings.

Advancement of Agency Mission: The Solar Decathlon advances workforce development in the buildings industry by preparing future professionals to design and construct high-performance buildings. Through industry partnerships, teams are also encouraging industry to advance towards zero energy designs at a faster pace.

Plan for Upcoming Two Fiscal Years: The Building Technologies Office will continue funding the 2024 Design Challenge and 2025 Design Challenge.

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[99] The website for Solar Decathlon 2023 Build Challenge is accessible at https://www.solardecathlon.gov/event/challenges-build.html.

[100] The website for Solar Decathlon 2023 Design Challenge is accessible at https://www.solardecathlon.gov/event/challenges-design.html.

A.5.25.   Solar Forecasting Round 1[101]

Sponsoring Agency and Office: Office of Energy Efficiency & Renewable Energy

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The American-Made Solar Forecasting Prize was designed to better enable solar industry stakeholders with state-of-the-art solar forecasting capabilities. Sponsored by the DOE Solar Energy Technologies Office (SETO), this prize aims to increase the use of the Solar Forecast Arbiter (SFA), an open platform developed by the University of Arizona, to allow for the transparent, rigorous, and consistent analysis and evaluation of solar forecasts. The Solar Forecasting Prize sought to accomplish several goals, including: increase stakeholder awareness of the state of the art in solar forecasting; incentivize the participation of a broad range of competitors from the solar forecasting industry and research and development space; increase industry knowledge of the SFA platform and its potential; promote the adoption of uniform and transparent metrics and specifications for solar forecasts using SFA (or similar platforms) by forecast end-users; and identify algorithms that perform better than a baseline probabilistic forecast. The Solar Forecasting Prize had a total prize purse of $375,000.

Advancement of Agency Mission: The results of the Solar Forecasting Prize demonstrated the state-of the art in probabilistic solar forecasting to relevant stakeholders as well promoted the usage a common platform such as the Forecast Arbiter platform (developed with DOE funding) for the fair, consistent, and transparent evaluation of probabilistic solar forecasts.

Plan for Upcoming Two Fiscal Years: The SETO is currently developing an FY23 Prize (Net-load Forecasting Prize) with plans to launch the Prize in February 2023. SETO will continue to look for ways to use the prize funding mechanisms for future prizes, but there is no third forecasting-based prize planned at the moment.

A.5.26.   Sunny Awards[102]

Sponsoring Agency and Office: Solar Energy Technologies Office

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Community solar is a form of solar energy generation that allows all community members to access the meaningful benefits of renewable energy, particularly those with low to moderate incomes, renters, and those for whom traditional rooftop solar is unavailable. The benefits of community solar include greater household savings, low- and moderate-income household access, increased resilience, community ownership, and equitable workforce development. The White House set a goal to achieve a decarbonized electricity system by 2035 and net-zero emissions by 2050. To ensure an equitable clean energy transition, the White House also announced the Justice40 initiative, which directs that 40% of the overall benefits of certain federal investments—including clean energy investments—flow to disadvantaged communities. Community solar will play a pivotal role in achieving these goals. The Sunny Awards for Equitable Community Solar (the Sunny Awards) recognize community solar projects and programs that develop or employ best practices to increase equitable access to the meaningful benefits of community solar for subscribers and their communities. The Sunny

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[101] The website for Solar Forecasting Round 1 is accessible at https://www.herox.com/sunnyawards.
[102] The website for Sunny Awards is accessible at https://www.herox.com/sunnyawards.

Awards will deliver up to $100,000 in cash prizes to winning competitors. In addition, competitors may also receive non-monetary recognition.

Advancement of Agency Mission: The winners of the Sunny Awards will highlight industry best practices for incorporating meaningful benefits into community solar projects and programs. SETO will leverage these projects and programs as examples to promote best practices, including through project case studies. SETO will also invite winners to be guest speakers at webinars and conferences and hold a Sunny Awards Roadshow to travel and collect more information and media about each project. The winners will help SETO develop guidance and replicable models on designing and developing equitable community solar.

Plan for Upcoming Two Fiscal Years: N/A

A.6.   Environmental Protection Agency (EPA)

A.6.1. Cleaner Indoor Air During Wildfire Challenge[103]

Sponsoring Agency and Office: Office of Research and Development

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Smoke from wildfires, prescribed burns, and poor ambient air quality around the world contribute to substantial clinical, public health, and economic societal burdens. Fine particulate matter (PM2.5), a major pollutant found in smoke, has been linked to respiratory and cardiovascular health effects including ischemic heart disease, stroke, cardiovascular mortality, and aggravation of asthma and Chronic obstructive pulmonary disease (COPD). Current public health advice for protection from smoke exposure during wildland fires is to stay indoors, preferably in a "cleaner room" with filtered air, close windows and doors, and minimize physical exertion. Owning and maintaining air purifiers that are currently on the market for residential use is financially out of reach for many who are most at risk from smoke exposures. In addition, wildfires often occur in the summer and early fall, in regions of the country where many homes do not have air conditioning, so closing windows can lead to very high indoor temperatures. The U.S. Environmental Protection Agency (EPA) is partnering with federal, state, local, and tribal agencies to encourage the development of new, low-cost approaches to clean fine particulate matter from indoor air. In addition to affordability and particulate removal, additional desirable characteristics include air cooling and operability during a power outage. The intent of the challenge is to focus attention on the problem, inspire development of solutions, and stimulate the market to commercialize effective solutions. An innovative, low-cost solution would have enormous public health impact by reducing air pollution exposures for people across the United States and throughout the world.

Advancement of Agency Mission: The mission of EPA is to protect human health and the environment. The Cleaner Air During Wildfires Challenge is one component of a broader EPA research project expanding the understanding of indoor air quality during wildland fire smoke events and approaches to reduce smoke exposures and related public health risks. Through this Challenge, EPA and its partners intend to encourage the development of new approaches, technologies, or technology combinations that can be used in homes to improve indoor air quality during wildland fire smoke events or other high air pollution episodes.

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[103] The website for Cleaner Indoor Air During Wildfire Challenge is accessible at https://www.epa.gov/air-research/winners-cleaner-indoor-air-during-wildfires-challenge.

Plan for Upcoming Two Fiscal Years: Winners of Phase II of the challenge will be announced in Spring 2024.

A.6.2. EEFs: Environmental and Agronomic Challenge[104]

Sponsoring Agency and Office: Office of Research and Development

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Nitrogen and phosphorus fertilizers facilitate the growth of crops, including corn, at yields that provide sustained global food production. However, fertilizers applied without consideration of the appropriate rate, timing, source, and method, can have harmful effects on the environment and human health. "Enhanced Efficiency Fertilizer" (EEF) is a term for new formulations that control fertilizer release or alter reactions that reduce nutrient losses to the environment. EEFs and other product technology innovations may be an important addition to a system of conservation practices that help reduce the impacts from row crop agriculture on the environment, while maintaining or increasing agricultural productivity and profitability. This Challenge aims to identify existing EEFs currently on or near-market that meet or exceed certain environmental and agro-economic criteria.

Advancement of Agency Mission: Clean Air and Water are central to EPA's Mission. If successful, recent peer reviewed estimates on increasing EEF in the U.S. suggest that environmental benefits range from $5-8 billion (mostly from improvements to water quality but also air quality), benefits to farmers range from $180-300 million, and benefits to the fertilizer industry range from $100-160 million.

Plan for Upcoming Two Fiscal Years: N/A

A.6.3. Innovative Ways to Destroy PFAS[105]

Sponsoring Agency and Office: Office of Research and Development

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: EPA launched the "Innovative ways to destroy PFAS" challenge on the www.Challenge.gov website in August 2020, in collaboration with ECOS/ERIS, the U.S. Department of Defense, Michigan Department of Environment, Great Lakes & Energy (EGLE), and the Colorado Department of Public Health & Environment (CDPHE). The presence of Per- and Polyfluorinated Substances (PFAS) in the environment is one of the most pressing environmental issues facing our nation. The unique chemical characteristics of PFAS lead to their bio-persistence in the environment and make their complete destruction extremely difficult. This innovation challenge was launched to identify non-combustion ways of destroying PFAS in concentrated aqueous film forming foam (AFFF), a type of firefighting foam. With this challenge, EPA was specifically looking for submissions that could destroy at least 99 percent of PFAS in unused AFFF, without creating any harmful byproducts. The challenge closed in late November, and 64 detailed submissions from 18 countries around the world were received. All the submissions were thoroughly and independently evaluated by EPA scientists,

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[104] The website for EEFs: Environmental and Agronomic Challenge is accessible at https://www.epa.gov/innovation/next-gen-fertilizer-challenges#EFFs.

[105] The website for Innovative Ways to Destroy PFAS is accessible at https://www.epa.gov/innovation/innovative-ways-destroy-pfas-challenge.

including members of EPA's PFAS Innovative Treatment Team and key representatives from the Department of Defense (DoD). EPA also would like to extend our gratitude to our federal and state partners—DoD, ECOS/ERIS, Michigan, and Colorado—for their assistance and expertise in evaluating the top proposals we received. Judging is complete and winners of the ORD prizes for the Innovative Ways to Destroy PFAS Challenge were awarded. First place was $40,000 awarded to Aquagga, Inc. for a portable hydrothermal solution. Second place was a tie between $10,000 to Xiao (Sarah) Wu of the University of Idaho for a continuous flow liquid-phase plasma discharge (CFLPPD) solution and $10,000 [divided into $5,000 each] to a photoactivated reductive defluorination solution by partners Ramboll and Cheng Gu of Nanjing University.

Advancement of Agency Mission: EPA collaborated on the challenge with the U.S. Department of Defense's Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP); the Environmental Council of States (ECOS) and the Environmental Research Institute of the States (ERIS); Michigan Department of Environment, Great Lakes & Energy; and Colorado Department of Public Health & Environment. Challenge winners will have the opportunity to submit their winning design concepts to DoD's SERDP/ESTCP programs for further testing.

Plan for Upcoming Two Fiscal Years: None reported.

A.6.4. Let's Talk About Heat Challenge[106]

Sponsoring Agency and Office: Office of the Administrator

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The Let's Talk About Heat Challenge was a national competition to identify innovative and effective communication strategies that inform people of the risks of extreme heat and offer ways to keep safe during the hottest days.

Advancement of Agency Mission: EPA will continue to share the winning messages with other communities nationwide, which have the potential to help EPA achieve its mission to protect public health, in this case from the impacts of extreme heat.

Plan for Upcoming Two Fiscal Years: None reported.

A.6.5. NARS Data Analysis Innovation Challenge[107]

Sponsoring Agency and Office: Office of Water

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The EPA Office of Water invites graduate students, scientists, academics, statisticians, and other analysts to apply the National Aquatic Resource Surveys (NARS) data to examine questions related to national priorities including climate change, environmental justice, nutrient management, and other critical water quality challenges. EPA encourages individuals and teams of researchers that incorporate a variety of disciplines (e.g., environmental science, biology, ecology,

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[106] The website for Let?s Talk About Heat Challenge is accessible at https://www.epa.gov/innovation/lets-talk-about-heat-challenge.

[107] The website for NARS Data Analysis Innovation Challenge is accessible at https://www.epa.gov/innovation/national-aquatic-resource-surveys-data-analysis-innovation-challenge.

geochemistry, statistics, economics, health and social sciences) to apply. Through this Challenge, OW is seeking analysis of the data generated by NARS, alone or in combination with other data, to 1) Identify signals or patterns of a changing climate in the data including measures of resiliency and the effectiveness of mitigation on the health of aquatic resources; 2) Uncover patterns of inequity in the distribution of healthy or degraded waters related to EJ metrics such as income, race, etc.; 3) Support efforts to assess nutrient water quality and more effectively protect and restore waters from nutrient pollution; 4) Contribute to the continuous improvement of NARS and other monitoring and programs.

Advancement of Agency Mission: The results of the NARS Data Challenge will be used to promote the use of NARS data in scientific research and provide new and innovative ways to use and examine NARS data.

Plan for Upcoming Two Fiscal Years: N/A

A.6.6. Next Gen Fertilizer Innovations Challenge[108]

Sponsoring Agency and Office: Office of Research and Development

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: Nitrogen and phosphorus fertilizers facilitate the growth of crops, including corn, at yields that provide sustained global food production. However, fertilizers applied without consideration of the appropriate rate, timing, source, and method can have harmful effects on the environment and human health. "Enhanced Efficiency Fertilizer" (EEF) is a term for new formulations that control fertilizer release or alter reactions that reduce nutrient losses to the environment. EEFs and other next generation product technology innovations may be an important addition to a system of conservation practices that help reduce the impacts from row crop agriculture on the environment, while maintaining or increasing agricultural productivity and profitability. This Challenge aims to identify concepts for novel technologies for fertilizers and other product technology innovations that can reduce the environmental effects from modern agriculture while maintaining or increasing crop yields. Submissions to the Next Gen Fertilizer Innovation Challenge may include technologies that are not currently on the market or technology concepts that are not traditional EEFs and not in commercial use as a fertilizer.

Advancement of Agency Mission: Clean Air and Water are central to EPA's Mission. If successful, recent peer reviewed estimates on increasing EEF in the U.S. suggest that environmental benefits range from $5-8 billion (mostly from improvements to water quality but also air quality), benefits to farmers range from $180-300 million, and benefits to the fertilizer industry range from $100-160 million.

Plan for Upcoming Two Fiscal Years: N/A.

A.6.7. Sustainable Communities Hackathon Challenge[109]

Sponsoring Agency and Office: Office of Research and Development

Authority: America COMPETES Reauthorization Act of 2010

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[108] The website for Next Gen Fertilizer Innovations Challenge is accessible at https://www.epa.gov/innovation/next-gen-fertilizer-challenges#EFFs.

[109] The website for Sustainable Communities Hackathon Challenge is accessible at https://model.earth/community/challenge/.

Competition Summary: The U.S. Environmental Protection Agency (EPA), Code for America, and the Georgia Center of Innovation for Energy Technology launched the Sustainable Communities Web Challenge to customize community starter websites for communities that can help identify and assess opportunities for increased sustainability. The challenge was open to the general public. Participants were asked to choose a location of interest ranging from a local community to multiple states. They could then choose from a variety of topic areas listed on the challenge website to develop, customize, and improve community-focused web resources that integrate the EPA's US Environmentally-Extended Input-Output (USEEIO) life cycle model of the US economy with data from other sources to inform community sustainability practices and innovative new development. Participants could work individually or in teams and competed for $10,000 in awards. The challenge culminated in a full-day showcase event and award presentation on October 2, 2021. Winners included a School-based sustainability initiatives website, and impact profile nutrition label for New York state, a site to promote community involvement in Los Angeles, and site building on the concept of land stewardship in Hawaii.

Advancement of Agency Mission: The challenge was used to educate participants on the use of EPA's USEEIO-based information to inform community sustainability.

Plan for Upcoming Two Fiscal Years: N/A.

A.6.8. TRI Companies Crushing Video Challenge[110]

Sponsoring Agency and Office: Office of Chemical Safety and Pollution Prevention

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: EPA launched a challenge in December 2021 promoting innovation in pollution prevention at industrial and federal facilities. The Challenge invited high school, and college students, and other individuals to use the Toxics Release Inventory (TRI) Pollution Prevention (P2) Search Tool to identify a TRI facility that has reported implementing source reduction practices and make a video illustrating how those practices or techniques benefit the business and positively impact communities and the environment. The challenge is now closed.

Advancement of Agency Mission: The video challenge would have provided video to be shared at conferences, via the website and through social media. This communication would also be shared nationwide with pollution prevention providers to support their outreach efforts with manufacturers.

Plan for Upcoming Two Fiscal Years: Relaunch and adapt challenge for FY2023: TRI Pollution Prevention Works: A Storytelling Challenge for Students.

A.7. General Services Administration (GSA)

A.7.1. Applied AI Challenge[111]

Sponsoring Agency and Office: Federal Acquisition Service

Authority: America COMPETES Reauthorization Act of 2010

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[110] The website for TRI Pollution Prevention Works Student Challenge is accessible at https://www.challenge.gov/?challenge=companies-crushing-pollution-video-challenge&tab=rules.

[111] The website for Applied AI Challenge is accessible at https://www.challenge.gov/?challenge=applied-ai-challenge.

Competition Summary: General Services Administration Technology Transformation Service (TTS) developed the Applied AI Challenge to assist agencies with adoption of artificial intelligence (AI) and related technologies to better serve the American people. The open competitive process encourages out-of-the-box solutions, along with opportunities for participants to demonstrate a direct application of promising AI technologies. TTS offers this competition to quickly identify, demonstrate, test, and acquire promising new AI technology products. The Applied Artificial Intelligence Challenge exists to accelerate the use of AI tooling related to the COVID-19 pandemic and the societal and environmental problems that relate to it. We aim to engage eligible U.S.-based companies and organizations with particular emphasis on startup and leading-edge technology companies. In addition, we encourage participation from large and small enterprises, women-owned, minority-owned, small disadvantaged, and service-disabled veteran-owned small businesses.

Advancement of Agency Mission: The Applied AI Challenge increased the size and awareness in the federal community of the AI Community of Practice. More than 160 attendees participated in the Applied AI Challenge Industry Day. In addition, one of the winners of the Applied AI Challenge was selected for acquisition by US DOD and US Forest Service.

Plan for Upcoming Two Fiscal Years: GSA FAS TTS Centers of Excellence will run two challenges with a total value of $200,000 in prizes.

A.8. National Aeronautics and Space Administration (NASA)

A.8.1. DEI Entrepreneurs Challenge[112]

Sponsoring Agency and Office: Science Mission Directorate

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: NASA's investment in technology development and infusion of viable new capabilities is fundamental to sustained success and critical to achieving its science goals. The Entrepreneurs Challenge seeks to identify fresh ideas and new partners (especially small start-up companies) to support the development of instruments and technologies that can dramatically improve future science missions and to leverage external funding sources to achieve science goals.

Advancement of Agency Mission: Many winners leveraged this challenge to received outside funding to develop their technologies, using the NASA prize as an indication of technical merit. We expect that some of these technologies will be proposed to mainstream NASA solicitations for further development and others will be incorporated into commercial products that we can buy.

Plan for Upcoming Two Fiscal Years: This prize competition is planned again for FY23.

A.8.2. Minority Serving Institutions (MSI) Space Accelerator Competition[113]

Sponsoring Agency and Office: Headquarters

Authority: America COMPETES Reauthorization Act of 2010

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[112] The website for DEI Entrepreneurs Challenge is accessible at https://www.nasa.gov/press-release/nasa-launches-entrepreneurs-challenge-to-identify-innovative-ideas.

[113] The website for Minority Serving Institutions (MSI) Space Accelerator Competition is accessible at https://nasa-space-accelerator.com.

Competition Summary: To increase the participation of underrepresented academic institutions in its technology portfolio, NASA's Science Mission Directorate awarded, through a two-round process, $50,000 in prize funding and admission to a Starburst-operated ten-week startup accelerator program to Minority Serving Institutions who successfully contributed ideas that advance the state-of-the-art in the area of Verifiable System-Level Autonomy for Future Science Missions. Under this prize challenge, NASA sought the design and/or demonstration of introspective agents that could perform effective monitoring of such autonomous systems to diagnose problems and optimize, reconfigure, and recover from failure. These agents would learn and adapt to improve their behavior over time, including acquiring, modifying, and transforming their activities by augmenting their knowledge on how to perform tasks more effectively and efficiently.

Advancement of Agency Mission: In the summer of 2023, the Earth Science Technology Office - Advanced Information Systems Technology (AIST) program is scheduled to release an open solicitation that will include topics related to trusted autonomy, artificial intelligence, and machine learning. Grants of up to $1,000,000 per year may be offered. The MSI Challenge helped prepare the teams to submit relevant proposals to this solicitation.

Plan for Upcoming Two Fiscal Years: N/A

A.8.3. NASA TechLeap Prize: Autonomous Observation Challenge No. 1[114]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: To support future missions, NASA seeks to advance observation capabilities using adaptive, distributed, heterogeneous networks of spacecraft, suborbital, and ground-based sensors working cooperatively. The challenge was administered by Carrot and received 17 submissions from the United States. 3 winners were awarded.

Advancement of Agency Mission: The challenge allowed NASA to identify integrated, compact precision pointing systems for small spacecraft that can be used to autonomously detect, locate, track, and collect data on transient terrestrial events such as aerosol dispersion in the atmosphere or maintain line of sight communication with an object on the lunar surface.

Plan for Upcoming Two Fiscal Years: Future iterations of the TechLeap Prize may be held as funding permits.

A.8.4. NASA TechLeap Prize: Nighttime Precision Landing Challenge No. 1[115]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: To support future missions, NASA seeks to advance the affordability and reduce the complexity of precision landing capabilities to deliver spacecraft to safe landing locations,

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[114] The website for NASA TechLeap Prize: Autonomous Observation Challenge No. 1 is accessible at https://www.autonomousobservation1.nasatechleap.org/home.

[115] The website for NASA TechLeap Prize: Nighttime Precision Landing Challenge No. 1 is accessible at precisionlanding1.nasatechleap.org.

particularly when the terrain is hazardous and lighting conditions are challenging. The challenge was administered by Carrot and received 12 submissions from the United States. 3 winners were awarded.

Advancement of Agency Mission: The challenge allowed NASA to identify sensing systems that could be capable of sensing terrain in the dark from an altitude of 250 meters or higher to help identify hazards and safe landing sites for spacecraft.

Plan for Upcoming Two Fiscal Years: Future iterations of the TechLeap Prize may be held as funding permits.

A.8.5. NASA TechRise Student Challenge 1[116]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The NASA TechRise Student Challenge invited teams of sixth to 12th-grade students to design, build, and launch experiments on NASA-supported test flights. Guided by an educator, student teams affiliated with U.S. public, private, and charter schools can submit ideas for experiments to test on either a suborbital rocket with about three minutes of microgravity (i.e., weightlessness) or a high-altitude balloon with exposure to Earth's atmosphere and views of our planet. The challenge was administered by Future Engineers and received 569 submissions. 57 winners were awarded.

Advancement of Agency Mission: The NASA TechRise Student Challenge was designed to engage and educate students in NASA's science and test flight efforts.

Plan for Upcoming Two Fiscal Years: Future iterations of the TechRise Student competition may be held as funding permits.

A.8.6. NASA TechRise Student Challenge 2[117]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: NASA is calling on middle and high school students to join the second NASA TechRise Student Challenge, which invites student teams to submit science and technology experiment ideas to fly on a high-altitude balloon. Students in sixth to 12th grades attending a U.S. public, private, or charter school –including those in U.S. territories –are challenged to team up with their schoolmates to design an experiment under the guidance of an educator. Administered by Future Engineers, the challenge offers hands-on insight into the design and test process used by NASA-supported researchers. It aims to inspire a deeper understanding of Earth's atmosphere, surface features, and climate; space exploration; coding; electronics; and the value of test data. The challenge received 505 submissions and will award 60 winners in 2023.

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[116] The website for NASA TechRise Student Challenge 1 is accessible at https://www.futureengineers.org/nasatechrise.

[117] The website for NASA TechRise Student Challenge 2 is accessible at https://www.futureengineers.org/nasatechrise.

Advancement of Agency Mission: It aims to inspire a deeper understanding of Earth's atmosphere, surface features, and climate; space exploration; coding; electronics; and the value of test data.

Plan for Upcoming Two Fiscal Years: Future iterations of the TechRise Student Challenge may be held as funding permits.

A.9.   National Science Foundation (NSF)

A.9.1. Taking Action: COVID-19 Diversity, Equity, & Inclusion Challenge[118]

Sponsoring Agency and Office: Directorate for Education and Human Resources

Authority: America COMPETES Reauthorization Act of 2010

Competition Summary: The "Taking Action: COVID-19 Diversity, Equity & Inclusion" Challenge was an ideas challenge for Institutions of Higher Education (IHEs). The challenge was designed to highlight the need for institutional solutions to mitigate the long-term, negative impacts of the COVID-19 pandemic on the diversity, equity, and inclusion (DEI) of undergraduate and graduate students, postdoctoral researchers, and faculty in Science, Technology, Engineering, and Mathematics (STEM). All eligible IHEs were encouraged and invited to submit descriptions of institutional actions that have been implemented, or would be implemented, such as new and revised policies, procedures, and practices to ensure continued progress toward more diverse, equitable, and inclusive STEM higher education programs and institutions.

Advancement of Agency Mission: The winning solutions were highlighted in a national showcase webinar for each of the four categories for the winners (undergraduate 2-year, undergraduate 4-year, graduate and postdoc, and faculty). These webinars have been archived both by NSF and the NSF INCLUDES National Hub. Potential grantees to NSF Programs can use these as resources to spark ideas for systemic change efforts within their own IHEs with or without NSF funding.

Plan for Upcoming Two Fiscal Years: Unknown.

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[118] The website for Taking Action: COVID-19 Diversity, Equity, & Inclusion Challenge is accessible at https://www.nsf.gov/edu/Covid19Challenge/Home.jsp.

Appendix B.   Prizes and Challenges under Other Authorities

This Appendix provides summaries of select prizes and challenges voluntarily submitted by agencies that were conducted in FY19 and FY20 under authorities other than COMPETES. Agency reporting on prizes and challenges under other authorities was optional, and therefore the activities presented here are representative rather than comprehensive. Please note that agency plans for the upcoming two fiscal years are notional and subject to the availability of funding.

B.1.   Department of Commerce (USDOC)

B.1.1. PETs Prize Challenge: Advancing Privacy-Preserving Federated Learning[119]

Sponsoring Agency and Office: NA

Authority: NA

Competition Summary: NA

Advancement of Agency Mission: None reported

Plan for Upcoming Two Fiscal Years: None reported

B.2.   Department of Defense (DOD)

B.2.1. 2021 SERDP AFFF Challenge[120]

Sponsoring Agency and Office: Under Secretary of Defense Acquisition and Sustainment

Authority: Unknown

Competition Summary: Legacy aqueous film forming foams (AFFF) used by the DoD and other civil and governmental agencies as a firefighting foam for class B pool fires are facing increasing regulatory scrutiny throughout the world due to environmental concerns associated with per- and polyfluoro alkyl substances (PFAS). PFAS are persistent in the environment, and the DoD is requiring PFAS-free firefighting agents in the near future. The DoD's Strategic Environmental Research and Development Program and Environmental Security Technology Certification Program are tasked with developing and demonstrating PFAS-free firefighting agents for use as a replacement for legacy AFFF. This challenge provided an opportunity for individuals and industrial firms of various sizes to contribute to the development of an AFFF alternative by submitting innovative formulations which could approach the performance of legacy AFFF.

Advancement of Agency Mission: 5 submissions were selected for award of $10,000. They were also invited to submit proposals for up to $250,000 to further develop their formulations.

Plan for Upcoming Two Fiscal Years: N/A

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[119] There was no website provided for PETs Prize Challenge: Advancing Privacy-Preserving Federated Learning.

[120] The website for 2021 SERDP AFFF Challenge is accessible at https://www.challenge.gov/?challenge=2021-serdp-afff-challenge.

B.2.2. Controlled Unclassified Information (CUI) Tool Automation Challenge[121]

Sponsoring Agency and Office: Navy

Authority: 10 U.S.C. 2374a

Competition Summary: The Naval Surface Warfare Center, Philadelphia Division, in coordination with government partners, is seeking ideas and solutions for an automated tool that leverages artificial intelligence (AI) and/or machine learning (ML) capabilities to aid users with the proper marking of documents in accordance with the Controlled Unclassified Information (CUI) program requirements. Established by Executive Order 13556, the CUI program standardizes the way the Executive branch handles unclassified information that requires safeguarding or dissemination controls pursuant to and consistent with law, regulations, and Government-wide policies. The objective of the Prize Challenge was for automating the process of assessing documents and data files for CUI content using AI/ML.

Advancement of Agency Mission: The challenge showed that applying AI/ML to the marking of CUI documents is possible. Further efforts will be made to continue finding a way to develop a tool that can be implemented for agency use.

Plan for Upcoming Two Fiscal Years: None reported

B.2.3. Hack - A - Sat 3[122]

Sponsoring Agency and Office: Air Force

Authority: 10 USC 4025

Competition Summary: In its 3rd year, Hack-A-Sat is designed to inspire the world's top cybersecurity talent to develop the skills necessary to help reduce vulnerabilities and build more secure space systems. The United States Air Force and the United States Space Force jointly present Hack-A-Sat, which is open to all cybersecurity researchers who want to up their skills and knowledge of space cybersecurity. This Capture-The-Flag challenge begins with a Qualification Event and culminates in an attack/defend style Final Event. Over the past two years, the Hack-A-Sat community has learned a lot about hacking in space. We've learned to keep our batteries charged, terms like nadir and how to compute quaternions in our sleep. As a result, Hack-A-Sat 3 offers the most realistic space environment yet. We're building a global alliance of hackers, researchers and everyday enthusiasts who nerd out on hacking and securing the future of space. Along the way, we're continuing to make our learnings public, so anyone can catch up, learn and play in our evolving library of resources available.

Advancement of Agency Mission: Results from Hack-A-Sat 3 will be used to help reduce vulnerabilities and build more secure space systems.

Plan for Upcoming Two Fiscal Years: We will be holding Hack-A-Sat 4 during FY23

B.2.4. Innovation Combine[123]

Sponsoring Agency and Office: Army - The Assistant Secretary of the Army for Acquisition, Logistics and Technology

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[121] There was no website provided for Controlled Unclassified Information (CUI) Tool Automation Challenge.
[122] The website for Hack - A - Sat 3 is accessible at www.hackasat.com.
[123] There was no website provided for Innovation Combine.

Authority: Title 10 USC 4025

Competition Summary: NA

Advancement of Agency Mission: None reported

Plan for Upcoming Two Fiscal Years: None reported

B.2.5. Innovation Combine 2.0[124]

Sponsoring Agency and Office: Army - the Army (Acquisition, Logistics, and Technology), U.S. Army Futures Command (AFC)

Authority: title 10 4025

Competition Summary: The U.S. Army Futures Command (AFC) partnered with the Assistant Secretary of the Army (Acquisition, Logistics, and Technology) (ASA(ALT)) to deliver the xTechInnovation Combine. The U.S. Army recognized that it must enhance engagements with eligible U.S.-based companies and organizations by understanding the spectrum of 'world-class' technologies being developed commercially that may benefit the DOD, integrating the sector of commercial innovators into the DOD science and technology ecosystem, and providing mentorship and expertise to accelerate, mature, and transition technologies of interest to the DOD. The Innovation Combine provided an opportunity for eligible entities (i.e., companies and organizations) to pitch novel advanced energy storage technology solutions directly to the U.S. Army. The competition awarded up to $120k in cash prizes and up to $1M in OTA's. In addition to non-dilutive cash prizes, entities had the opportunity to engage with the U.S. Army and other partners through information sharing and networking opportunities. The Innovation Combine provided operational and technical feedback from U.S. Government subject matter experts on proposed concept white papers submitted to the competition and offered finalists cash prizes and opportunities to participate in the xTechInnovation Combine Accelerator to receive education, mentorship, and networking opportunities to help grow their businesses for military and commercial users.

Advancement of Agency Mission: The xTechInnovation Combine allowed the Army to understand the various solutions being developed in the commercial sector that aligned with the advanced energy storage topic area. Through this competition, the U.S. Army was able to down-select to the top 2 companies and award a follow-on contract, integrating the businesses into the Army's ecosystem.

Plan for Upcoming Two Fiscal Years: N/A

B.2.6. MagQuest[125]

Sponsoring Agency and Office: National Geospatial-Intelligence Agency, Source Directorate, Office of Geomatics

Authority: Economy Act

Competition Summary: The U.S. National Geospatial-Intelligence Agency (NGA) is sponsoring MagQuest to accelerate novel approaches to geomagnetic data collection for the World Magnetic Model (WMM).

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[124] The website for Innovation Combine 2.0 is accessible at https://www.xtech.army.mil/competition/xtech-innovation-combine/.

[125] The website for MagQuest is accessible at https://www.herox.com/MagQuest.

Because the Earth's magnetic fields are constantly in motion, government agencies and private businesses alike depend on regularly updated measurements to keep modern life running smoothly. All of our navigation systems, from the GPS guiding commercial airliners to the map apps in our smartphones count on the WMM. Yet the current WMM relies on data from an aging satellite system. With MagQuest, NGA aims to inspire and encourage the development of powerful new technologies to collect the magnetic measurements essential for updating and maintaining the WMM. During this stage of the competition, Phase 4a, the three remaining teams will build their proposed magnetometers — tools to measure magnetic forces. Then, their magnetometers will undergo independent testing at NASA's world-renowned Goddard Space Flight Center. The three teams will receive up to several million dollars in awards and are competing for a piece of an up to $1.55 million incentive prize purse in Phase 4a, plus an invitation to move onto the next phase and put their magnetometers on satellites and ultimately launch their innovative systems.

Advancement of Agency Mission: Three winning teams from MagQuest Phase 3 proposed different magnetometer designs to measure the Earth's magnetic field. In Phase 4a, these teams will develop their proposed magnetometers and NASA Goddard Space Flight Center will conduct independent testing on each team's prototype. Following Phase 4a, successful teams will integrate their magnetometers into their satellites and launch their systems, acquire data and share their results with NGA. The ultimate goal is for all three teams to successfully develop a magnetometer, each of which can be sent into orbit to determine viability for WMM production. NGA's objective is to test as many innovative and groundbreaking magnetometers as possible to ensure a robust set of data suppliers to support the future of the WMM. NGA intends to have a competitive procurement for a data-buy contract following MagQuest and hope that these three teams, in addition to others from industry, will be able to supply comprehensive data sets to support the future of the WMM.

Plan for Upcoming Two Fiscal Years: MagQuest consist of four phases: Phase 1 Concepts; Phase 2 Detailed Designs and Plans for Data Collection Methodologies; Phase 3: Refined Designs, Testing Plans and Cost Estimates for WMM Data Collection Methodologies; and Phase 4: Technology Demonstration which is the current phase. Phase 4a (instrument testing) was initiated in FY'21 with a planned completion in 4QFY'23. Phase 4b (satellite build and test) and 4c (launch and data delivery) are in the planning phase but expected to launch in FY'23 and end in FY'26. Three Solvers (participants) will start 4b in late FY'23 and continue throughout FY'24 with completion expected in FY'25. Phase 4c is expected to start in FY'25 for each Solver and run through the end of FY'26.

B.2.7. Mobile Standoff Autonomous Indoor Capabilities (MoSAIC) Challenge[126]

Sponsoring Agency and Office: Under Secretary of Defense for Policy - IWTSD

Authority: DoD Authority, NDAA 2000 and NDAA 2007 (extended)

Competition Summary: The Irregular Warfare Technical Support Directorate (IWTSD) and the Israel Ministry of Defense (IMOD) Directorate of Defense Research and Development (DDR&D) in partnership with the Merage Institute of California executed the Mobile Standoff Autonomous Indoor Capabilities (MoSAIC) Challenge to illuminate innovative technological solutions from companies and researchers around the globe that enable fully autonomous and remote indoor maneuver, specifically cutting edge AI algorithms and novel robotic platforms, that when integrated can overcome the unique challenges

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[126] The website for Mobile Standoff Autonomous Indoor Capabilities (MoSAIC) Challenge is accessible at https://mosaichallenge.com/.

inherent to maneuvering in enclosed spaces. We are particularly interested in discovering non-traditional solvers outside the defense sector and incentivizing them to apply their civilian technologies to this challenging problem through prize money, recognition, and mentorship opportunities. Recognizing that this is a hard problem without a single solution, MoSAIC was executed as five "mini challenges" that addressed the fundamental elements of autonomous maneuver which included indoor navigation, room mapping, human/object tagging, and tactical robotic platforms. Additionally, challenge included a 5th category for through-wall human presence detection. MoSAIC entailed two phases with two distinct tracks. The first was an online call for submissions where submitters provided a description of their technology and other information in an online questionnaire. A multi-U.S. agency and multi-national judging panel down-selected online submissions that best met the judging criteria to demonstrate their technologies either virtually in an online simulation or physically in a representative field environment in Israel.

Advancement of Agency Mission: Operational end users will also be able to leverage IWTSD Bilateral Agreements to further develop and evaluate promising solutions discovered under MoSAIC to address their operational capability gaps relevant to autonomous indoor maneuver.

Plan for Upcoming Two Fiscal Years: N/A

B.2.8. Safer and More Effective Less than Lethal Capabilities for Area Denial and Crowd Control[127]

Sponsoring Agency and Office: Under Secretary of Defense for Policy - Irregular Warfare Technical Support Directorate

Authority: DoD authority, NDAA 2000 and NDAA 2007 (extended)

Competition Summary: Security forces around the world need capabilities that deliver compelling effects without inflicting undue harm to those in a crowd while ensuring effective protection to the security forces employing the capability. Two key tasks within this domain are area denial and crowd control. Such events may include a specific individual or a group of people and may happen in an open area or a confined space. It is undeniable that safer and more effective methods to accomplish these tasks benefit all parties involved. The objective of the Safer and More Effective Lethal Capabilities Challenge was to identify innovative new technologies for area denial and crowd control. Submitters were asked to address methods that are useable at a distance and applicable to individuals and/or groups in open areas and/or methods effective against all occupants of a confined space without requiring the user to enter that confined space. Solutions must not cause permanent physical harm to the target subjects. The Challenge solicited two levels of submissions for two different levels of awards: first, ideation level submissions consisting of descriptions of novel ideas, concepts, and approaches addressing the goals of the Challenge; and second, theoretical level submissions consisting of a detailed description with detailed supporting information.

Advancement of Agency Mission: The results will be provided to the relevant operational communities to enable the following: safer and more effective, wide-spread, homogeneous influence on large scale crowds in open areas or confined spaces; more accurate and effective disabling of individuals in the

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[127] The website for Safer and More Effective Less than Lethal Capabilities for Area Denial and Crowd Control is accessible at https://www.wazoku.com/challenges/cttso-challenge-safer-and-more-effective-less-than-lethal-capabilities-for-area-denial-and-crowd-control/.

crowd (while maintaining the requirement of reduced lethality, especially at short interaction distances); and the dispersion of massive unruly crowds or clearing of a confined space without entry.

Plan for Upcoming Two Fiscal Years: N/A

B.2.9. xTech Plugfest[128]

Sponsoring Agency and Office: Army - the Assistant Secretary of the Army (Acquisition, Logistics, and Technology); Program Executive Office for Intelligence Electronic Warfare & Sensors (PEO IEW&S), Project Manager Positioning Navigation & Timing (PM PNT), the U.S. Army Combat Capabilities Development Command (DEVCOM) and the C5ISR (Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance) Center

Authority: Title 10 USC 4025 and Title 10 U.S.C. § 2371b

Competition Summary: The Program Executive Office for Intelligence Electronic Warfare & Sensors (PEO IEW&S), Project Manager Positioning Navigation & Timing (PM PNT), the U.S. Army Combat Capabilities Development Command (DEVCOM) and the C5ISR (Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance) Center in partnership with the Army (Acquisition, Logistics, and Technology) (ASA(ALT)), announced the xTechPlugfest Competition in August 2021 to award and accelerate technology solutions that demonstrated the capabilities that currently exist for PNT CMOSS cards, CMOSS switch cards, and CMOSS chassis to meet CMOSS compliance. Finalist were invited to demonstrate their technology solutions and compete for prize money at the PNT CMOSS Plugfest event scheduled in November 2021 at Aberdeen Proving Grounds, MD. The competition provided opportunities for participants to engage directly with key Army stakeholders, receive direct feedback and earn cash prizes as they advanced. The competition awarded up to $200k in cash prizes. These efforts were pursued under the authorities of 10 U.S.C. § 2374a.

Advancement of Agency Mission: The xTechPlugfest competition provided an opportunity for the Army to understand the spectrum of technologies being developed around the CMOSS needs. The competition provided an opportunity to understand how to integrate the top solutions into the Army's current ecosystem.

Plan for Upcoming Two Fiscal Years: N/A

B.2.10.   xTechBOLT[129]

Sponsoring Agency and Office: Army - Assistant Secretary of the Army for Acquisition, Logistics and Technology and U.S. Army Medical Research and Development Command

Authority: Title 10 USC 4025

Competition Summary: USAMRDC in partnership with ASA(ALT) launched and executed the xTech Brain Operant Learning Technology (xTechBOLT) prize competition between August 2020 and November 2021, to incentivize industry to develop and demonstrate the use of one or more tools to locate, track, and trace four types of learning traits including explicit and implicit knowledge, from exposure to storage, and use those neural pathways to capture emotions and empathy and research a proof of concept mechanism (software and/or hardware) that could be developed to promote optimal retention

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[128] The website for xTech Plugfest is accessible at https://www.xtech.army.mil/competition/xtech-plugfest/.
[129] The website for xTechBOLT is accessible at https://www.xtech.army.mil/competition/xtechbolt/.

and access to memories. The goals for the competition were to understand the effects of emotion and empathy on learning and memory and the functional roles played by various brain regions and their mutual interactions in relation to emotional and empathetic processing and the effects on both implicit and explicit learning that could revolutionize how we teach and train warfighters and medical providers and how we utilize novel brain operant learning technologies. The Army and DOD sought "path finding" teams and technologies through this competition, aiming to find early-stage innovations with the potential to dramatically improve military training outcomes with novel hardware and/or software-based technologies. The xTechBOLT competition received applications from companies and academic institutions across the U.S. that consisted of short concept white papers and short videos. The top 10 applicants were selected as semifinalists, awarded $10,000 in cash prizes, and invited to conduct a live presentation during the 2020 I/ITSEC. The top 5 finalists were selected and awarded additional cash prizes of $25,000 each and invited to conduct a proof-of-concept demonstration the following year at 2021 I/ITSEC where the 1st place winner received a cash award of $500,000; 2nd place, $125,000; 3rd place, $75,000; 4th place, $50,000; and 5th place, $25,000.

Advancement of Agency Mission: xTechBOLT is a competition targeting "path finding" teams and technologies to find early-stage innovations with the potential to dramatically improve military training outcomes with novel hardware- and/or software-based technologies.

Plan for Upcoming Two Fiscal Years: N/A

B.2.11.   xTechCMFF IntegrationFest[130]

Sponsoring Agency and Office: Army - the Assistant Secretary of the Army (Acquisition, Logistics, and Technology) (ASA(ALT)); Program Manager Mission Command (PM MC), the U.S. Army Combat Capabilities Development Command (DEVCOM) Command, Control, Communications, Computers, Cyber, Intelligence, Surveillance and Reconnaissance/Electronic Warfare (DEVCOM C5ISR/EW), C5ISR Prototype Integration Facility, (PIF), Product Manager (PM) Interoperability Integration and Services (PM I2S), PM Tactical Radios (TR), PM Position Navigation and Timing (PNT), C5ISR MOSA Management Office (MMO), Program Executive Office (PEO) C3T, PEO Aviation, PEO Ground Combat Systems (GCS), and the Network Cross Function Team

Authority: Title 10 USC 4025

Competition Summary: The U.S. Army invited interested entities to participate in the xTechCMFF Integration Fest, a forum to engage with the Army, earn prize money, and provide an opportunity to test out CMFF aligned systems in a tactically relevant environment. PM MC, DEVCOM C5ISR/EW, C5ISR PIF, PM I2S, PM TR, PM PNT, C5ISR MMO, PEO C3T, PEO Aviation, PEO GCS, and the Network CFT partnered with ASA(ALT) to deliver the xTechCMFF Integration Fest. The xTechCMFF Integration Fest was an opportunity for eligible entities to pitch their novel, dual-use technology solutions directly to the U.S. DOD while awarding up to $100k in cash prizes to selected participants. The competition provided operationally relevant and technical feedback from Army experts on proposed ideas submitted to this competition and offered cash prizes to selected finalists along with direct exposure to key stakeholders and the opportunity to test out their products in tactically relevant environments. The U.S. Army's PM MC is working on developing and refining a CMFF reference architecture that provides industry with constraints to assist them in focusing their internal research and development spending to meet Army

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[130]   The   website   for   xTechCMFF   IntegrationFest   is   accessible   at https://www.xtech.army.mil/competition/xtechcmff-integration-fest/.

needs. Some of the biggest challenges currently anticipated for existing CMOSS Participants are heat dissipation in tactically relevant vehicles' environments, vibration and shock profiles of those vehicles, and vehicular size, weight, power, and cooling constraints that currently exist in the vehicles.

Advancement of Agency Mission: The xTechCMFF Integration Fest was able to assist the Army in understanding the spectrum of 'world-class' technologies being developed commercially that may benefit the DOD around the CMOSS/CMFF problem areas, integrating the sector of commercial innovators into the DOD science and technology ecosystem, and providing strategic exposure to key stakeholders to accelerate, mature, and transition technologies of interest to the DOD.

Plan for Upcoming Two Fiscal Years: N/A

B.2.12. xTechDetect[131]

Sponsoring Agency and Office: Army - the Assistant Secretary of the Army (Acquisition, Logistics, and Technology), U.S. Army Combat Capabilities Development Command (DEVCOM), the DEVCOM Forward Elements (DFE Americas, Atlantic, Pacific) and the U.S. Office of Naval Research Global (ONR-G)

Authority: Title 10 USC §4025

Competition Summary: The U.S. Army invited interested entities to participate in the xTechDetect competition. xTechDetect provided an opportunity to engage with the Army, earn prize money, and provide potential funding opportunities to tackle Army challenges within the counter-improvised explosive device (C-IED) space. The U.S. Army Combat Capabilities Development Command (DEVCOM), the DEVCOM Forward Elements (DFE Americas, Atlantic, Pacific), and the U.S. Office of Naval Research Global (ONR-G) have partnered with the Assistant Secretary of the Army (Acquisition, Logistics, and Technology) (ASA(ALT)) to deliver the xTechDetect competition. The competition awarded up to $270k in cash prizes to selected participants and provided opportunities for the finalists to conduct an in-person pitch presentation to a panel of Army experts while receiving direct feedback on how they can continue improving their solutions for both commercial and DOD use.

Advancement of Agency Mission: The xTechDetect competition was able to assist the Army in understanding the types of solutions currently being developed in the commercial sectors in the defined problem spaces.

Plan for Upcoming Two Fiscal Years: The xTech Program is currently looking at potentially launching another xTechDetect competition in FY23.

B.2.13. xTechGlobal AI Challenge[132]

Sponsoring Agency and Office: Army - Assistant Secretary of the Army (Acquisition, Logistics, and Technology), the US Air Force's AFWERX program, U.S. Navy Office of Naval Research-Global, U.S. Army Futures Command DEVCOM Atlantic

Authority: Title 10 USC 4025

Competition Summary: The US Army Futures Command (AFC)-DEVCOM Atlantic has partnered with Assistant Secretary of the Army (Acquisition, Logistics, and Technology) (ASA(ALT)), the US Air Force's

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[131] The website for xTechDetect is accessible at https://www.xtech.army.mil/competition/xtechdetect/.
[132] The website for xTechGlobal AI Challenge is accessible at https://www.xtech.army.mil/competition/xtechglobal-ai-challenge/.

AFWERX program, and the US Navy Office of Naval Research-Global (ONR-G) to deliver its first international tri-service competition, the xTechGlobal Artificial Intelligence (AI) Challenge. The xTechGlobal AI Challenge allowed the U.S. Army to engage with eligible international small to medium enterprises in the US Army Combat Capabilities Development Command (DEVCOM) Atlantic Area of Responsibility (AOR), including Europe, the Middle East and Africa, to identify robust, AI-enabled capabilities to manage, integrate, and process disparate data/information sources for rapid decision making. The services recognized that there was a need for the DOD to enhance engagements with international businesses, while understanding the spectrum of 'world-class' technologies being developed commercially that may benefit the DOD, integrating the sector of small business innovators into the DOD science and technology ecosystem, and providing mentorship and expertise to accelerate, mature, and transition technologies of interest to the DOD. The competition awarded up to $250k in cash prizes to selected participants and culminated in a finals event that was held in London, UK in September 2021 awarding the 1st place winner $70k, 2nd place $50k, and 3rd place $30k.

Advancement of Agency Mission: The crosscutting topic areas contained this in AI Challenge are important across the US DOD. Collaborators from the US Army Artificial Intelligence Task Force, DEVCOM Army Research Laboratory, US Army 75th Innovation Command, US Air Force Office of Scientific Research (AFOSR), and ONR-G were involved in the competition planning and topic curation. Given the global mission of DEVCOM, a key aspect of this challenge will be increasing interoperability with our foreign partners. DOD will leverage international partners at the I-HUB, including UK Ministry of Defense (MOD) and UK Defence and Security Accelerator (DASA), to further the exposure and networking opportunities provided to selected participants in this contest.

Plan for Upcoming Two Fiscal Years: The xTech Program plans to run an xTechInternational competition in FY23 and FY24

B.2.14.   xTechHBCU Faculty[133]

Sponsoring Agency and Office: Army - The Assistant Secretary of the Army for Acquisition, Logistics and Technology; the Combat Capabilities Development Command (DEVCOM) Army Research Laboratory (ARL) Army Research Office (ARO)

Authority: 10 U.S.C. § 4025 and 10 U.S.C. § 2362

Competition Summary: The Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASA(ALT)) is announcing its newest xTech competition, in partnership with the Combat Capabilities Development Command (DEVCOM) Army Research Laboratory (ARL) Army Research Office (ARO), the xTech Historically Black Colleges & Universities and Minority Serving Institutions (also referred to as xTechHBCU). xTechHBCU aims to engage with eligible institutions as defined below, and highlight opportunities to collaborate with the Army to tackle critical Army challenges, earn prize money, network with Army program managers and provide potential funding opportunities to tackle Army challenges.

Advancement of Agency Mission: The ASA(ALT) recognizes that diverse perspectives provide a critical source of innovative talent and novel concepts for the advancement of Army Modernization Priorities and national security. In a concerted effort to attract truly novel perspectives, this initiative will target covered institutions that have historically received less funding than their counterparts, such as non-

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[133] The website for xTechHBCU Faculty is accessible at https://www.xtech.army.mil/competition/xtechhbcu/.

Tier 1 (R1) colleges and universities, with the intent to fund institutions that have not otherwise received a significant amount of funding from the DoD Research Development Test and Evaluation (RDT&E) programs.

Plan for Upcoming Two Fiscal Years: There are currently plans to launch and xTechHBCU Student competition in FY22/FY23 and potential plans to conduct another xTechHBCU competition in FY23/FY24

B.2.15.   xTechHBCU Student[134]

Sponsoring Agency and Office: Army - The Assistant Secretary of the Army for Acquisition, Logistics and Technology

Authority: 10 U.S.C. §4025 (formerly 2374a), 10 U.S.C. §4144, 10 U.S.C. § 4022 (Prototype Projects), and 10 U.S.C. § 2192

Competition Summary: he U.S. Army invited eligible HBCU Students to participate in the xTech Historically Black Colleges & Universities – Student Competition. xTechHBCU Student is a forum for eligible HBCU students across the U.S. to engage with the Department of Defense, earn prize money, participate in a unique accelerator program, and potentially have an opportunity to develop a prototype or seek a patent for their designed solutions as final winners of the competition. The competition finals will be held at or around the 2023 Black Engineer of the Year Award Science, Technology Engineering, and Mathematics Conference from February 9-11, 2023. The Assistant Secretary of the Army for Acquisition, Logistics and Technology recognizes that the Army must enhance engagements and highlight opportunities for HBCUs. Diverse perspectives provide a critical source of innovative talent and novel concepts for the advancement of Army Modernization Priorities and national security. The xTechHBCU Student Competition will provide a structured and focused entry path for eligible undergraduates to submit novel concepts and technology solutions directly to the U.S. Army. Participants will receive detailed feedback from Army and DOD stakeholders; and will have access to training, mentorship, networking opportunities through the xTechHBCU Student Accelerator. The xTechHBCU Student Competition will provide non-dilutive seed prizes to select undergraduate students. The efforts described in this notice are being pursued under the authorities of 10 U.S.C. §4025 (formerly 2374a), 10 U.S.C. §4144, 10 U.S.C. § 4022 (Prototype Projects), and 10 U.S.C. § 2192.

Advancement of Agency Mission: The xTechHBCU Student competition has allowed the U.S. Army to further develop relationships with HBCUs and HBCU Students. The competition has also provided the opportunity to see unique ideas that can overall support the Army's Warfighters.

Plan for Upcoming Two Fiscal Years: None reported

B.2.16.   xTechInternational[135]

Sponsoring Agency and Office: Army - The Assistant Secretary of the Army for Acquisition, Logistics and Technology; the U.S. Army Futures Command (AFC), Combat Capabilities Development Command (DEVCOM), U.S. Army Corps of Engineers, Engineer Research and Development Center (ERDC), and the U.S. Office of Naval Research Global (ONR-G)

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[134] The website for xTechHBCU Student is accessible at https://www.xtech.army.mil/competition/xtechhbcu-student/.

[135]   The   website   for   xTechInternational   is   accessible   at https://www.xtech.army.mil/competition/xtechinternational/.

Authority: Title 10 USC 4025

Competition Summary: The U.S. Army Futures Command (AFC), Combat Capabilities Development Command (DEVCOM), U.S. Army Corps of Engineers, Engineer Research and Development Center (ERDC), and the U.S. Office of Naval Research Global (ONR-G) partnered with Assistant Secretary of the Army (Acquisition, Logistics, and Technology) (ASA(ALT)) to deliver the xTechInternational competition. The Army recognizes that DOD must enhance engagements with eligible international small businesses by understanding the spectrum of 'world-class' technologies being developed commercially that may benefit the DOD, integrating the sector of non-traditional innovators into the DOD science and technology ecosystem, and providing mentorship and expertise to accelerate, mature, and transition technologies of interest to the DOD. The xTechInternational2022 competition provided an opportunity for eligible international small businesses to pitch their novel, dual-use technology solutions directly to U.S. DOD and foreign government stakeholders. The competition provided operationally-relevant and technical feedback from Army experts on proposed ideas submitted to this competition and offered finalists cash prizes and opportunities to participate in an xTech Accelerator, where they will receive education, mentorship and networking opportunities to help them understand the Army ecosystem and how to grow their businesses. The competition consisted of three-rounds: a call for concept white papers, a virtual technology pitch event, and a final pitch event. The competition awarded 14 finalists prizes of $10,000 each and invitations to conduct in-person or virtual final pitches in the U.S. The top 5 companies were selected and awarded an additional prize of up to $60,000 for 1st place and up to $40,000 for 2nd place for each topic area. Participants had opportunities to engage with DOD stakeholders and other international partners through an accelerator program.

Advancement of Agency Mission: The xTechInternational competition allowed the U.S. Army to understand the realm of solutions being developed in the commercial sector in three key areas: water, energy, and synthetic biology. As a result of the competition, the U.S. Army is looking for ways to continue working with some of the applicants because the solutions they offered could be game-changing.

Plan for Upcoming Two Fiscal Years: The xTech program currently plans to launch an xTechInternational competition in FY23 and in FY24.

B.2.17.   xTechManufacture[136]

Sponsoring Agency and Office: Army - The Assistant Secretary of the Army (Acquisition, Logistics, and Technology); the Office of the Under Secretary of Defense for Research and Engineering (OUSD R&E); U.S. Air Force, U.S. Navy, U.S. Missile Defense Agency, and U.S. Defense Logistics Agency

Authority: Title 10 USC 4025

Competition Summary: The xTechManufacture competition provided an opportunity for eligible entities to pitch novel advanced manufacturing solutions directly to the DOD. In addition to non-dilutive cash prizes, entities had the opportunity to engage with the DOD and other partners through information sharing and networking opportunities. The xTechManufacture competition provided operational and technical feedback from DOD subject matter experts on proposed ideas submitted to this competition and offered finalists cash prizes and opportunities to participate in the 2022 DMC where there were additional networking opportunities. The competition awarded up to $445k in cash prizes to selected

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[136]   The   website   for   xTechManufacture   is   accessible   at https://www.xtech.army.mil/competition/xtechmanufacture-2/.

participants. The purpose of the xTechManufacture competition is to invest in the critical and emerging technologies outlined below and address the manufacturing challenges affecting the ability of the defense industrial base to advance technologies into acquisition systems by engaging new industry partners and providing an opportunity to pitch novel technology solutions directly to the DOD. The ability to de-risk and scale-up manufacturability is a critical element of our national security. Given the advancements and complexities of requirements for soldier and weapon systems, proposals submitted to this competition may have interest to various Department-wide research and procurement programs. While the authority of this program is 10 U.S.C. § 4025, a concept white paper submitted to the xTechManufacture competition may generate interest by another DOD organization for a funding opportunity outside of this program. The interested DOD organization may or may not result in opportunities outside of this competition.

Advancement of Agency Mission: The xTechManufacture competition allowed the DOD to better understand the spectrum of 'world-class' technologies being developed commercially that may benefit the DOD in the manufacturing space and integrate the sector of commercial innovators into the DOD science and technology ecosystem.

Plan for Upcoming Two Fiscal Years: In FY23, the xTechManufacture competition will be ongoing and completed. There are potential plans to launch future iterations of the competition.

B.2.18.   xTechRCCTO AStRA[137]

Sponsoring Agency and Office: Army - The Assistant Secretary of the Army (Acquisition, Logistics, and Technology); U.S. Army's Rapid Capabilities and Critical Technologies Office (RCCTO)

Authority: Title 10 USC 4025; Title 10 USC 2371b

Competition Summary: The U.S. Army invited interested business entities and academic institutions to participate in the xTechRCCTO Army Strategic Rapid Acquisition (AStRA) competition (RCCTO Innovation Day 3) conducted between April and July 2021. AStRA was designed to engage with eligible large and small U.S-based companies and organizations and host a forum to collaborate with the Army, earn prize money, and provide potential funding opportunities to tackle Army technology gaps for both the Program Executive Officer (PEO) for Intelligence Electronic Warfare & Sensors and PEO Soldier RCCTO.

Advancement of Agency Mission: RCCTO's mission is to rapidly and efficiently research, develop, prototype, test, evaluate, procure, transition, and/or field critical enabling technologies and capabilities that address near-term and mid-term threats. RCCTO executes this mission consistent with the Army's modernization priorities that maximize soldiers' capabilities to deploy, fight, and win on future battlefields. The U.S. Army faces an increasingly lethal and disruptive battlefield, requiring quick acquisition of innovative capabilities to prototype and deliver to the warfighter. AStRA is an opportunity for eligible businesses to pitch their novel technology solutions and prototypes directly to the U.S. Army.

Plan for Upcoming Two Fiscal Years: There are currently no plans to run and execute another competition in FY23/FY24

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[137] The website for xTechRCCTO AStRA is accessible at https://www.xtech.army.mil/competition/xtechrccto-astra/.

B.2.19. xTechSBIR[138]

Sponsoring Agency and Office: Army - The Assistant Secretary of the Army for Acquisition, Logistics, and Technology

Authority: 10 USC 4025, 10 USC 2371b, and 15 USC 638

Competition Summary: The U.S. Army invited interested entities to participate in the xTech Small Business Innovation Research (SBIR) competition. The xTechSBIR provided a forum for small businesses to collaborate with the Army, earn prize money, and engage with other non-traditional Army partners. Winners of the xTechSBIR were invited to submit a Direct to Phase II (D2PhII) SBIR proposal to prototype their proposed technology innovations on a variety of topic areas to include, Combat Vehicle Modernization, Autonomous Navigation Sensor Technologies, Advanced Real Time Global High-Resolution Environmental Information to Support Multi-Domain Operations, Ultra Narrow-band Emergency Radio, Non-Lethal Vehicle Defense System, and Condition Based Maintenance for Combat Vehicles. Up to $864k in cash prizes were awarded to selected participants through the Army xTech program and up to $40M in D2PhII SBIR awards were available through the Army Applied SBIR program. The competition was used to identify small business concerns that meet the criteria for award of a D2PhII contract under 15 U.S.C. §638.

Advancement of Agency Mission: This prize competition sought diverse and/or innovative solutions; incentivized a larger number of submissions, employed a low risk approach and/or pay-for-performance structure, was less burdensome to design and execute than alternatives, identified and worked with new innovators, promoted awareness of a specific topic or agency research area; and built upon previous success with a prize competition.

Plan for Upcoming Two Fiscal Years: There are plans to launch new xTechSBIR competitions in FY23/FY24

B.2.20. xTechSBIR Clean Tech[139]

Sponsoring Agency and Office: Army - the Assistant Secretary of the Army (Acquisition, Logistics, and Technology)

Authority: 10 U.S.C. § 4025, 10 U.S.C. § 4022, and 15 U.S.C. § 638.

Competition Summary: The U.S. Army invited interested entities to participate in the xTech Small Business Innovation Research (SBIR) Clean Tech competition, a clean tech open-topic competition to engage with the Army, earn prize money, and provide potential funding opportunities to tackle Army challenges within the clean tech space. Winners of xTechSBIR Clean Tech competition were invited to submit a Phase I or a Direct to Phase II SBIR proposal to prototype their proposed technology innovations. The xTechSBIR Clean Tech competition was sponsored by the Assistant Secretary of the Army (Acquisition, Logistics, and Technology). As the Army aims to reduce greenhouse gas emissions by 30% by 2030, ASA(ALT) is committed to that mission through supporting technological innovation and utilizing the Army xTech and SBIR programs to help in achieving the Army's overarching goals. The ASA(ALT) recognizes that the U.S. Army must enhance engagements with small businesses by understanding the spectrum of 'world-class' technologies being developed commercially within the

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[138] The website for xTechSBIR is accessible at https://www.xtech.army.mil/competition/xtechsbir/.

[139] The website for xTechSBIR Clean Tech is accessible at https://www.xtech.army.mil/competition/xtechsbir-cleantech/.

clean tech realm, that may benefit the Army, integrating the sector of commercial innovators into the Army's science and technology ecosystems, and providing mentorship and expertise to accelerate, mature, and transition technologies of interest to the Army.

Advancement of Agency Mission: The xTechSBIR Clean Tech competition allowed the Army to gain a better understanding of the technologies being developed in the commercial sector and the impact they could potentially have on the Army's current needs, resulting in the desire to award follow-on SBIR contract awards to continue developing solutions to meet the Army's needs.

Plan for Upcoming Two Fiscal Years: The xTech program plans to release future iterations of xTechSBIR competitions.

B.2.21. xTechSBIR Waveform[140]

Sponsoring Agency and Office: Army

Authority: Title 10 USC 4025

Competition Summary: The Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASA(ALT)) in partnership with the U.S. Army Program Executive Office Command Control Communications-Tactical (PEO C3T) would like to invite interested entities to participate in the xTech Small Business Innovation Research (SBIR) Waveform Challenge. The xTech|SBIR Waveform Challenge incentivizes small businesses to propose innovative, viable technology concepts to the Army to develop an open hardware architecture for software defined radios (SDRs) that can facilitate the decoupling of hardware and software-based waveforms. Each participant with a selected Concept White Paper received a $10,000 prize and were invited to participate in Part 2: Technology Pitches where participants had an opportunity to present their technology concept to an Army panel. Winners of the Part 2: Technology Pitches received an additional $50,000 cash prize and were invited to participate in Part 3, to submit either a Phase I SBIR or a Direct to Phase II (D2PhII) SBIR proposal to prototype their proposed technology innovations. Prize money was awarded to selected participants through the Army xTech program and SBIR contract awards were awarded through the Army SBIR program. The prize competition, consisting of Part 1: Concept White Paper and Part 2: Technology Pitch, was used to identify small business concerns that meet the criteria for award of a Phase I or D2PhII SBIR contract under 15 U.S.C. §638. Winners selected from Part 2: Technology Pitches were the only firms eligible to participate in Part 3 and submit a Phase I or D2PhII SBIR proposal under this announcement.

Advancement of Agency Mission: The xTechSBIR Waveform Challenge allowed the Army to understand the types of technologies available in the commercial sector that can solve current capability gaps with tactical radios. The competition allowed the Army to award Direct to Phase II contracts to the top-5 companies to continue further technology developments to meet the Army's needs.

Plan for Upcoming Two Fiscal Years: There are potential plans to run additional xTechSBIR focused competitions on various topic areas as needs arise across the Army.

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[140] The website for xTechSBIR Waveform is accessible at https://www.xtech.army.mil/competition/xtechsbir-waveform/.

B.2.22.   xTechSearch 6[141]

Sponsoring Agency and Office: Army - The Assistant Secretary of the Army for Acquisition, Logistics and Technology

Authority: Title 10 USC 4025 and Title 15 USC 638

Competition Summary: The Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASA(ALT)) announced the sixth iteration of its open topic prize competition, Expeditionary Technology Search (xTechSearch), in 2021 to highlight opportunities for small businesses to collaborate with the Army to tackle the most critical Army modernization challenges. ASA(ALT) recognizes that the Army must enhance engagements with small businesses by understanding the spectrum of technologies being developed commercially that may benefit the Army, integrating the sector of small business innovators into the Army's science and technology (S&T) ecosystem, and providing mentorship and expertise to accelerate, mature, and transition technologies of interest to the Army. The xTechSearch 6 competition provided increasing cash prizes to select small businesses. Ultimately, 10 final winners were selected following the proof-of-concept demonstrations held May 10-12, 2022 at the AUSA Conference Center in Arlington, VA, and received awards of $25K each, as well as have the opportunity to submit for a Phase I Small Business Innovation Research (SBIR) award of up to $250K each. The xTechSearch competition strives to integrate small businesses into the Army's S&T ecosystem by providing research opportunities with Army labs, including authorized access to the Army's organic intellectual and technical capital. Participants had access to training, mentorship, and other support infrastructure as they progress through the contest to determine how best to align their technology solutions with real users and buyers within the Army. Finalists were entered into the xTech Accelerator to receive intensive mentorship and access to networking events to help grow their companies for Army and commercial users.

Advancement of Agency Mission: xTechSearch assists the Army in understanding the technology solutions being developed in the commercial sector that can assist in solving critical needs.

Plan for Upcoming Two Fiscal Years: The xTech Program plans to launch xTechSearch 7 in FY23 and xTechSearch 8 in FY24.

B.2.23.   xTechSearch 7[142]

Sponsoring Agency and Office: Army - The Assistant Secretary of the Army for Acquisition, Logistics, and Technology

Authority: Title 10 USC 4025, 15 U.S.C. § 638 and 10 U.S.C. § 4022

Competition Summary: The U.S. Army invited interested entities to participate in the Expeditionary Technology Search competition, a forum for eligible sole proprietors and small businesses across the U.S. to engage with the DOD, earn prize money, participate in the accelerator program, and potentially submit applications for a Phase I Small Business Innovation Research (SBIR) award. xTechSearch offers an opportunity for eligible participants to pitch novel technology solutions—a new application for an existing technology or an entirely new technology concept—to the Army. The Assistant Secretary of the Army for Acquisition, Logistics, and Technology recognizes that the Army must enhance engagements

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[141] The website for xTechSearch 6 is accessible at https://www.xtech.army.mil/competition/xtechsearch-6/.
[142] The website for xTechSearch 7 is accessible at https://www.xtech.army.mil/competition/xtechsearch-7/.

with small businesses by understanding the spectrum of 'world-class' technologies being developed commercially that may benefit the DOD in the manufacturing space and integrating the sector of commercial innovators into the DOD science and technology ecosystem.

Advancement of Agency Mission: The competition received over 750 applications in Part 1 and is currently preparing for the xTechSearch 7 finals event with the top-20 teams who will conduct a live pitch to a panel of Army and DOD experts across the Science and Technology Ecosystem. Up to ten teams will be selected as final winners of the competition and will receive a cash prize of $25k each, in addition to the opportunity to submit for a Phase I SBIR award of up to $250,000 each.

Plan for Upcoming Two Fiscal Years: The xTech program plans to run future iterations of xTechSearch in both FY23 and FY24

B.2.24. xView3 Challenge[143]

Sponsoring Agency and Office: Defense Innovation Unit

Authority: Title 10 4025 (formerly 2374a)

Competition Summary: xView is a series of international computer vision competitions run by the Defense Innovation Unit (DIU) to advance, benchmark, and procure state-of-the-art artificial intelligence and machine learning solutions in the domain of humanitarian assistance and disaster response (HADR). We have partnered with DoD organizations; federal, state, and local first responders; and non-governmental organizations to create and release big, high-quality, and open datasets and algorithms aligned to specific prediction tasks that are relevant to HADR and the world at large. The prior xView competition, xView2, released the world's largest dataset for building damage assessment and sourced computer vision solutions to automate building damage assessment using satellite imagery from before and after natural disasters. More than 2,000 submissions were received, resulting in three winning solutions with 90% damage detection and classification success rate. Winning solutions were deployed to assist with a variety of natural disasters around the world in 2020 and beyond, from the Australian bushfires, to seasonal wildfires in California, to hurricanes and floods in the Southeastern U.S. to earthquakes in Syria and Turkey and to the man-made destruction in Ukraine. xView3 builds on the success of the preceding xView challenges, addressing the following goals: advance the state of the art in automated detection of fishing activity from synthetic aperture radar (SAR) imagery; increase the number of machine learning researchers working on maritime SAR imagery by releasing the largest, high-quality labeled dataset suitable for algorithm development; provide objective benchmarks by scoring submissions against hold-out data, thereby characterizing the level of performance for state-of-the-art solutions on this prediction task; procure winning algorithms as open source solutions, or where appropriate, utilize Title 10 4025 (formerly IAW 10 U.S.C. § 2374 Prize Challenge Authority.)

Advancement of Agency Mission: xView3 models have been productionized and integrated into government maritime domain awareness tools such as SeaVision and PROTEUS. Every combatant command around the world is using xView3 in addition to partner nations such as Australia as well as National Government Organizations.

Plan for Upcoming Two Fiscal Years: Launch xView4 in 2023.

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[143] The website for xView3 Challenge is accessible at https://iuu.xview.us/.

B.3.   Department of Health and Human Services (HHS)

B.3.1. 2023 Health Equity DataJam[144]

Sponsoring Agency and Office: Health and Human Services: Office of the Secretary

Authority: Contractor/partner organized

Competition Summary: Hosted by AcademyHealth, the 2022 Health Equity DataJam invited participants to transform raw data from the U.S. Department of Health and Human Services into actionable insights and digital tools to bridge disparities of health, including those exacerbated by the COVID-19 pandemic, and to ensure equitable access and wellness for all. HealthData.gov is a significant source of free and open data that can be used to investigate, illustrate, and innovate around solutions that help us understand, address, and respond to health inequities, disparities, and the social determinants of health. Like a virtual hybrid of a hackathon and challenge, the 2022 Health Equity DataJam invited teams to leverage data from healthdata.gov and other publicly available datasets to propose unique solutions or visualizations at the juncture of health equity and the social determinants of health. HHS provided the data sets and challenge questions, and AcademyHealth convened an evaluation panel to review submissions and recognize the best solutions. Winners had the opportunity to share their solutions at an AcademyHealth webinar series. Participants chose from one of the following four challenge tracks to be the focus of their proposed solution: 1. Access to Care, 2. COVID-19 and Health Equity, 3. Kidney Care and Health Equity, 4. Lyme Innovation and Health Equity.

Advancement of Agency Mission: HHS' HealthData.gov fuels new business models, scientific advancements, and collaborative innovation by making government data open to the public, easily discoverable, and machine readable. To encourage civic tech and public engagement, the HealthData.gov team organized information by health equity topics. We encourage everyone to browse these topics and discover issue-specific ideas, curated datasets, and resources to get started. Add your data skills, innovation, and expertise to help tackle the nation's biggest challenges.

Plan for Upcoming Two Fiscal Years: The Health Equity Datajam is an annual event, corresponding with the Health Datapalooza conference organized by AcademyHealth.

B.3.2. Detecting Emerging Threats in Injury and Violence using Network Science[145]

Sponsoring Agency and Office: Centers for Disease Control and Prevention

Authority: Procurement Authority

Competition Summary: CDC/National Center for Injury Prevention and Control (NCIPC) conducted this challenge to determine how network science can be used to support injury and violence surveillance and research. For this challenge, NCIPC was looking for innovative solutions that use network science to address one or more of their priority emerging injury health threats: adverse childhood experiences, suicide, and drug overdose.

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[144] The website for 2023 Health Equity DataJam is accessible at https://academyhealth.org/about/programs/2022-health-equity-datajam.

[145] The website for Detecting Emerging Threats in Injury and Violence using Network Science is accessible at https://www.freelancer.com/contest/detecting-emerging-threats-in-injury-and-violence-using-network-science-2019614.

Advancement of Agency Mission: The resulting solution from the data challenge was used by injury epidemiologists in CDC/NCIPC to leverage novel and real-time data sources to identify and characterize conversations around adverse childhood experiences in aid of prevention and intervention efforts.

Plan for Upcoming Two Fiscal Years: CDC averages about 3 prize competitions every fiscal year. With our FY2021 interagency agreement with NASA's Center of Excellence for Collaborative Innovation (CoECI), we are able to more strongly support prize competitions. There are at least two prize competitions planned for FY2023 using this mechanism with more under development. In FY2022, we developed an internal site to provide resources about federal prize competitions, crowdsourcing, and citizen science to build capacity within the agency.

B.3.3. Fatal Injury and Violence Analytics[146]

Sponsoring Agency and Office: Centers for Disease Control and Prevention

Authority: Procurement Authority

Competition Summary: CDC's National Center for Injury Prevention and Control (NCIPC) works to understand how injury and violence impact society and what can be done to prevent it. In this proof-of-concept challenge, we aim to create a prototype solution for detecting and exploring trends in fatal injury and violence data.

Advancement of Agency Mission: The resulting solution from the data challenge was used by injury epidemiologists in CDC/NCIPC to more quickly identify fatality trends and increase situational awareness at the national and state levels.

Plan for Upcoming Two Fiscal Years: CDC averages about 3 prize competitions every fiscal year. With our FY2021 interagency agreement with NASA's Center of Excellence for Collaborative Innovation (CoECI), we are able to more strongly support prize competitions. There are at least two prize competitions planned for FY2023 using this mechanism with more under development. In FY2022, we developed an internal site to provide resources about federal prize competitions, crowdsourcing, and citizen science to build capacity within the agency.

B.3.4. NIOSH Counterfeit N95 Challenge[147]

Sponsoring Agency and Office: Centers for Disease Control and Prevention

Authority: Procurement Authority

Competition Summary: The COVID-19 pandemic has unleashed an overwhelming flood of counterfeit respirators into the marketplace, especially N95 filtering facepiece respirators (FFRs). The National Institute for Occupational Safety and Health (NIOSH), part of CDC, works tirelessly to identify these counterfeits. This challenge seeks ideas for new approaches and technologies that help educate vendors and users about counterfeit respirators. The ultimate goals of this challenge are to reduce the number of counterfeit N95 FFRs in the marketplace and to improve the confidence of end users who will purchase these products.

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[146] The website for Fatal Injury and Violence Analytics is accessible at https://www.topcoder.com/challenges/160c1a09-4569-4752-9e3e-706bc82a0d36.

[147] The website for NIOSH Counterfeit N95 Challenge is accessible at https://www.herox.com/NIOSHCounterfeitN95; https://www.challenge.gov/?challenge=nioshcounterfeitn95.

Advancement of Agency Mission: Solutions and information gathered will be used to reduce counterfeit N95 FFRs from entering the marketplace and provide continued confidence in the NIOSH Respirator Approval Program. These efforts will directly advance efforts ensuring a standard level of quality and filtration efficiency for all respirators used in all U.S. occupational settings, as authorized by 42 CFR Part 84 and required by 29 CFR 1910.134.

Plan for Upcoming Two Fiscal Years: CDC averages about 3 prize competitions every fiscal year. With our FY2021 interagency agreement with NASA's Center of Excellence for Collaborative Innovation (CoECI), we are able to more strongly support prize competitions. There are at least two prize competitions planned for FY2023 using this mechanism with more under development. In FY2022, we developed an internal site to provide resources about federal prize competitions, crowdsourcing, and citizen science to build capacity within the agency.

B.3.5. The NIOSH Protective Clothing Challenge Leaving No Body Unprotected[148]

Sponsoring Agency and Office: Centers for Disease Control and Prevention

Authority: Procurement Authority

Competition Summary: U.S. workers require protective clothing that fits properly to perform their jobs safely. Protective clothing that fits poorly can compromise the safety and performance of people as they work, resulting in injuries and lost time to those trying to do their jobs and risks to those around them. The National Institute for Occupational Safety and Health (NIOSH), part of CDC, sought innovative solutions to help ensure that protective clothing designs consider the broad spectrum of U.S. workers in relation to factors that may influence fit such as body size and shape, gender, race, ethnicity, religious and cultural practices, or specific work tasks.

Advancement of Agency Mission: Solutions and information gathered will be used towards the development of a National Strategy for Equitable Personal Protective Equipment (PPE) Protections for all United States workers. Winning solutions have been asked to present at the NIOSH/NPPTL Equitable PPE Protections Workshop.

Plan for Upcoming Two Fiscal Years: CDC averages about 3 prize competitions every fiscal year. With our FY2021 interagency agreement with NASA's Center of Excellence for Collaborative Innovation (CoECI), we are able to more strongly support prize competitions. There are at least two prize competitions planned for FY2023 using this mechanism with more under development. In FY2022, we developed an internal site to provide resources about federal prize competitions, crowdsourcing, and citizen science to build capacity within the agency.

B.4. Department of the Energy (DOE)

B.4.1. Geothermal Lithium Extraction Prize[149]

Sponsoring Agency and Office: Geothermal Technologies Office

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[148] The website for The NIOSH Protective Clothing Challenge Leaving No Body Unprotected is accessible at https://www.herox.com/NIOSHProtectiveClothing; https://www.challenge.gov/?challenge=the-niosh-protective-clothing-challenge-leaving-no-body-unprotected.

[149] The website for Geothermal Lithium Extraction Prize is accessible at https://www.herox.com/GeothermalLithiumExtraction.

Authority: FY21 Geothermal Technologies Office Congressional Funding

Competition Summary: The Geothermal Lithium Extraction Prize was announced on March 31st, 2021. The Geothermal Lithium Extraction Prize consists of 3 phases over 18 months, with a total of $4M in prize winnings. The prize targets a diverse range of academic teams to participate, including technical schools, community colleges, and large research universities. Phase 1 teams will develop their ideas and concepts, Phase 2 teams will advance their designs and develop a test plan for Phase 3, and Phase 3 teams will fabricate and test their designs. During Phases 2 and 3, teams will have direct access to industry leaders in the Salton Sea to help mentor teams to ensure the success of their projects and build career-relevant skills.

Advancement of Agency Mission: Work under the prize helps provide a value-added opportunity for geothermal electricity generation while supporting access to cost-effective, domestic sources of lithium, a critical mineral for batteries used in stationary storage and electric vehicles. This work supports the Biden-Harris Administration's goals of 50% electric vehicle adoption by 2030 and a net-zero emissions economy by 2050, while helping to ensure American leadership in the clean energy future and creating U.S. jobs and a strong domestic supply chain.

Plan for Upcoming Two Fiscal Years: In September 2023, this prize concluded with the Geothermal Technologies Office announcing one winning team and two runners up, recognizing those teams' success in fabricating and testing lithium extraction prototypes in the third and final phase of the prize.

B.4.2. Solar District Cup[150]

Sponsoring Agency and Office: National Renewable Energy Laboratory

Authority: Department of Energy Science Education Enhancement Act

Competition Summary: The U.S. Department of Energy Solar District Cup Collegiate Design Competition challenges multidisciplinary student teams to design and model distributed energy systems for a campus or district. These systems integrate solar and battery storage across mixed-use districts or groups of buildings served by a common electrical distribution feeder. The competition engages students in engineering, finance, urban planning, sustainability, and other disciplines or degree programs to reimagine how energy is generated, managed, and used in a district. Student teams assume the role of a solar-plus-storage developer to produce a conceptual design and financing proposal as well as analyze electric distribution grid interactions for a district use case. Teams compete in one of multiple divisions, each structured around a district use case. The strongest submissions provide solutions that maximize the district's energy offset and financial savings over the contracted or useful life of the system while integrating aesthetic, infrastructure, and community considerations. Students submit written deliverable packages for evaluation and present their solutions to judges live at an online competition event, at which the winners are determined and announced. The Solar District Cup is designed to inspire students to consider new career opportunities, learn industry-relevant skills, engage with the professional marketplace, and prepare to lead the next generation of workforce in distributed solar energy. The program seeks to encourage collaboration between academia and industry through public-private partnerships.

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[150] The website for Solar District Cup is accessible at https://www.energy.gov/eere/solar/solar-district-cup, https://www.herox.com/SolarDistrictCup.

Advancement of Agency Mission: DOE has a history of supporting workforce development through competitions focused on project-based learning. Student competitors gain experience that prepares them for successful careers in solar and related energy fields, benefiting from mentorship, training, collaboration, and networking. The competition supports DOE's ongoing work to help industry address structural employment gaps through workforce development activities.

Plan for Upcoming Two Fiscal Years: N/A

B.5. Department of the Interior (DOI)

B.5.1. Automated Maintenance of Protection Systems (AMPS) Challenge[151]

Sponsoring Agency and Office: Bureau of Reclamation

Authority: Procurement

Competition Summary: The Automated Maintenance of Protection Systems (AMPS) Challenge sought methods to increase hydropower plant generation reliability through the development of a tool, a group of tools, a continuous monitoring system, or a surveillance system that communicates with existing protection systems to safely perform comprehensive online testing, avoiding the opportunity cost of unit outages. After the August 2003 blackout, the North American Electric Reliability Corporation (NERC) developed comprehensive reliability standards including testing requirements to prevent another large power outage. Currently, these testing protocols are labor-intensive and often require the plant to be off-line to complete. The AMPS Challenge seeks to automate protection systems testing, eliminate outages necessary to accomplish the testing, and improve hydropower plant reliability. The AMPS Challenge had two phases - a white paper and a prototype phase. Participants delivered a white paper submission describing their technical approach to the problem. Eight participants were selected to receive a prize and continue in the prototype phase. Participants developed their prototypes and shared design details for evaluation. Five prototypes were selected for testing by subject matter experts in Reclamation's Colorado.

Advancement of Agency Mission: Reclamation is the largest wholesale water supplier in the United States, operating 53 hydroelectric powerplants that produced 40 billion kilowatt-hours, on average, annually for the last 10 years. After the 2003 Blackout, a comprehensive list of testing protocols was developed and designed to prevent another large power outage. The results are included in the North American Electric Reliability Corporation Protection and Control (NERC PRC) regulatory standards which outlines key activities required to achieve basic utility reliability. NERC PRC-005-6, Protection System, Automatic Reclosing, and Sudden Pressure Relaying Maintenance includes the required testing and maintenance protocols related to this challenge. The current testing protocols are labor-intensive and often require the plant to be off-line; however, the NERC protection system maintenance standard allows for most of the maintenance activities to be automated and, with the extensive adoption of microprocessor-based relays, this automation is possible.

Plan for Upcoming Two Fiscal Years: Reclamation plans to continue identifying topics and plan for future competitions to address infrastructure, advanced water treatment, water availability, and environment where advancement or resolution of issues can contribute to Reclamation carrying out its mission more effectively or efficiently. Reclamation will continue to explore completed competition outcomes to

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[151] The website for Automated Maintenance of Protection Systems (AMPS) Challenge is accessible at https://www.usbr.gov/research/challenges/amps.html; https://www.freelancer.com/reclamation/amps.

determine pathways for potential further development, testing (lab or field), and potential implementation.

B.5.2. Canal Safety Challenge[152]

Sponsoring Agency and Office: Bureau of Reclamation

Authority: Procurement

Competition Summary: The Canal Safety Challenge, a collaboration with the Bureau of Reclamation, Denver Water, Klamath Irrigation District, and Pacific Gas and Electric Company, focused on discovering solutions to improve public safety and reduce drownings in canals throughout the U.S. and make egress from the canals easier or allow for safer rescue and recovery efforts. Canals with swift moving currents and in-line structures pose a risk to public safety, particularly in urban areas due to the proximity of population to these conveyance features. Canals can look like an inviting place to swim or play, but the water can be cold and swift. Steep, slippery canal walls make it difficult to climb out of a canal once a person or animal has entered it. Most Reclamation canals were built in remote, rural areas. The Canal Safety Challenge consisted of 3 phases - a white paper submission, prototype development, and laboratory-scale testing and demonstration.

Advancement of Agency Mission: Reclamation canals were built in remote, rural areas. Over the years, increasing populations and expanding communities near these canals has resulted in approximately 1,000 miles of Reclamation canals in urbanized areas. With urbanization, comes additional risks of drowning. Ladders, ropes, signage, and educational outreach have been used to spread awareness regarding canal safety; however, additional innovative concepts for facility modification may further reduce the public risk around Reclamation-owned canals. This competition spurred innovative concepts, methods, and technologies to reduce public safety accidents and drownings in canals.

Plan for Upcoming Two Fiscal Years: Reclamation plans to continue identifying topics and plan for future competitions to address infrastructure, advanced water treatment, water availability, and environment where advancement or resolution of issues can contribute to Reclamation carrying out its mission more effectively or efficiently. Reclamation will continue to explore completed competition outcomes to determine pathways for potential further development, testing (lab or field), and potential implementation.

B.5.3. Counting Every Drop Challenge[153]

Sponsoring Agency and Office: Bureau of Reclamation

Authority: Procurement

Competition Summary: The Counting Every Drop Challenge is seeking new and improved ground-based precipitation measurement devices that are reliable, accurate, low maintenance, and able to operate in remote locations under extreme environmental conditions. The ideal submission would not rely on fluids that require frequent maintenance, such as the use of antifreeze fluid to melt solid precipitation

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[152]   The website for Canal Safety Challenge is accessible at https://www.usbr.gov/research/challenges/canalsafety.html; https://www.canalsafetychallenge.org/.
[153]   The website for Counting Every Drop Challenge is accessible at https://www.usbr.gov/research/challenges/counteverydrop.html; https://www.freelancer.com/reclamation/counting-every-drop.

(e.g., snow, sleet, hail, etc.), would have low power demands, report data frequently, measure precipitation with high resolution and accuracy, have stable measurements not impacted by extreme weather conditions, and be easy to install, maintain, and calibrate. The Counting Every Drop Challenge is a two-phase challenge. Phase 1 competitors must submit a white paper describing their proposed precipitation measurement device and how it will satisfy the requirements. Up to eight Phase 1 competitors move forward to Phase 2. In Phase 2, competitors will complete their prototype which will be lab and field tested. Up to five competitors that show the ability to complete their prototype and meet the challenge requirements will continue work on their prototype and have the opportunity to work with a Subject Matter Expert (SME) who will advise in product and business development. Prior to sending the prototypes for testing, competitors will have a virtual meeting with Federal SMEs to demonstrate installation and operation of their prototype. Competitors with prototypes that are ready for the field will ship their prototypes for field deployment alongside a benchmark device for at least eight months.

Advancement of Agency Mission: New or improved devices that will better inform water management decisions critical for human safety and environmental health, including forecasting water supplies, monitoring water-year precipitation, controlling floods, and planning for irrigation needs.

Plan for Upcoming Two Fiscal Years: Reclamation plans to continue identifying topics and plan for future competitions to address infrastructure, advanced water treatment, water availability, and environment where advancement or resolution of issues can contribute to Reclamation carrying out its mission more effectively or efficiently. Reclamation will continue to explore completed competition outcomes to determine pathways for potential further development, testing (lab or field), and potential implementation.

B.5.4. Divide and Conquer: Modeling Large-Scale Hydraulics Faster[154]

Sponsoring Agency and Office: Bureau of Reclamation

Authority: Procurement

Competition Summary: Reclamation's Sedimentation and River Hydraulics Group is looking to improve the execution speed of numerical models that simulate hydraulics and sediment transport for rivers and reservoirs. Reclamation has created robust and reliable numerical models for simulating river and reservoir processes. However, current model execution is limited to cases with relatively small time and spatial scales, and does not meet the ever-increasing demand for addressing questions related to large river systems and variable hydrology over decadal time periods. The current algebraic linear equation solver used in the models can take as much as 60-80% of the total execution speed and can only run on single-core PCs. This prize competition has two phases. In Phase I, competitors create a new linear equation sparse matrix solver (LESMS) that is at least as stable as Reclamation's current solver and parallelized to run on multi-core PCs or GPU technology to meet speedup requirements. In Phase II, competitors incorporate their solver into a version of Reclamation's Two-Dimensional (2D) model and make the model run in multi-core parallel mode.

Advancement of Agency Mission: Reclamation's Sedimentation and River Hydraulics Group develops numerical (computer) models to simulate river hydraulics; sediment erosion, transport, and deposition;

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[154] The website for Divide and Conquer: Modeling Large-Scale Hydraulics Faster is accessible at https://www.usbr.gov/research/challenges/srh.html; https://www.freelancer.com/reclamation/divide-and-conquer.

water temperature; and riparian vegetation growth and mortality. Their research and development efforts include numerical model development, river channel process investigations, river structure design criteria, and sediment measurement. An important aspect of their work is the 1D, 2D, and 3D numeric modeling of rivers and reservoirs including river and floodplain hydraulics, sediment transport, lateral channel migration, and the linking vegetation growth and mortality to habitat.

Plan for Upcoming Two Fiscal Years: Reclamation plans to continue identifying topics and plan for future competitions to address infrastructure, advanced water treatment, water availability, and environment where advancement or resolution of issues can contribute to Reclamation carrying out its mission more effectively or efficiently. Reclamation will continue to explore completed competition outcomes to determine pathways for potential further development, testing (lab or field), and potential implementation.

B.5.5. Guardians of the Reservoir[155]

Sponsoring Agency and Office: Bureau of Reclamation

Authority: Procurement

Competition Summary: Reservoirs are bodies of stored fresh water that typically form behind dams. They are a critical water source, supplying farms with irrigation and providing potable water to people and homes. Increasingly, they are also an important component of outdoor, water-based recreation. Sediment enters reservoirs each year, particularly when rivers are experiencing floods or runoff conditions. Sediment accumulation reduces available water storage which affects the ability to meet critical operational objectives along with environmental, cultural and recreational needs. The lifespan of reservoirs relies on our ability to effectively and continually manage sediment. The goal of this challenge is to develop and demonstrate new processes and technologies that collect and transport sediment from reservoirs at a rate that sustains their current capacity. Reclamation's primary interest is in technology that will move sediment downstream at the average annual rate at which it would otherwise accumulate, but approaches that can help regain lost reservoir capacity are of interest if they can do so in addition to meeting environmental and other performance criteria. The Bureau of Reclamation, in collaboration with the U.S. Army Corps of Engineers, launched a three-phase Guardians of the Reservoir Challenge spanning nearly two years seeking solutions that develop more cost-effective sediment removal methods for reservoirs. This competition built upon the success of the Sediment Removal Techniques for Reservoir Sustainability competition and sought to continue progress in the development of new processes and technologies that collect and/or transport sediment from reservoirs at a rate that sustains their current capacity. The competition offered technical support, testing, and public presentation of participant solution opportunities for the most compelling ideas. This competition aimed to jumpstart interests and activities to improve sediment removal strategies.

Advancement of Agency Mission: Reservoir sedimentation has become a significant problem with the aging of water storage facilities. Sediment deposition in reservoirs limits the active life of reservoirs by reducing reservoir storage capacity for water supply or flood risk reduction. Sedimentation also impacts dam outlets, reservoir water intakes, water quality, recreation, upstream flood stage, and downstream habitat. Most reservoirs are older than 50 years and many are older than 100 years. The

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[155]   The website for Guardians of the Reservoir is accessible at https://www.usbr.gov/research/challenges/sediment-removal.html; https://www.herox.com/GuardiansoftheReservoir.

sediment-design life (typically 100 years) will be reached when the sediment level at the dam is higher than the outlet and the outlet is prone to plugging. New or improved techniques for reservoir sediment removal and transport of the removed sediment in a cost-effective manner is necessary for sustaining Reclamation's mission to carry out its critical operational objectives for reservoirs along with meeting environmental, cultural, and recreational needs.

Plan for Upcoming Two Fiscal Years: Reclamation plans to continue identifying topics and plan for future competitions to address infrastructure, advanced water treatment, water availability, and environment where advancement or resolution of issues can contribute to Reclamation carrying out its mission more effectively or efficiently. Reclamation will continue to explore completed competition outcomes to determine pathways for potential further development, testing (lab or field), and potential implementation.

B.5.6. Imperfection Detection[156]

Sponsoring Agency and Office: Bureau of Reclamation

Authority: Procurement

Competition Summary: The Bureau of Reclamation (Reclamation) is the largest provider of water and the second-largest producer of hydroelectric power in the United States. Reclamation's infrastructure uses all major civil engineering material classes, including steel, concrete, plastics, and composites, to achieve the performance, and service life needed. Typical applications for composite materials include fiber-reinforced polymer (FRP) pipelines, tanks, and other specialized infrastructure components, which take advantage of composites' excellent corrosion resistance, reduced weight, and other helpful materials properties. Evaluation tools and methods for concrete and steel infrastructure are well established; however, FRP composite structures require new and more advanced evaluation techniques. This competition consists of 3 phases comprising a white paper submission, prototype development, and laboratory-scale testing and demonstration.

Advancement of Agency Mission: Reliable and non-destructive methods are needed to assess the condition of aging fiber-reinforced polymer (FRP) pipelines, tanks, and other specialized components of water infrastructure. Developing portable tools that use non-destructive evaluation methods will reduce costs and labor associated with assessing the condition of existing FRP composite structures and provide capability to confirm the quality of newly received FRP composite structures, like pipes or gates.

Plan for Upcoming Two Fiscal Years: Reclamation plans to continue identifying topics and plan for future competitions to address infrastructure, advanced water treatment, water availability, and environment where advancement or resolution of issues can contribute to Reclamation carrying out its mission more effectively or efficiently. Reclamation will continue to explore completed competition outcomes to determine pathways for potential further development, testing (lab or field), and potential implementation.

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[156]   The website for Imperfection Detection is accessible at https://www.usbr.gov/research/challenges/imperfection.html; https://www.herox.com/ImperfectionDetection.

B.5.7. More Water Less Concentrate[157]

Sponsoring Agency and Office: Bureau of Reclamation

Authority: Procurement

Competition Summary: The More Water Less Concentrate Challenge was a public competition focused on discovering innovative, affordable, and environmentally sound solutions to reduce the volume of concentrate and generate more usable water from inland desalination plants. In many areas, particularly in the Western United States, existing fresh water sources are fully allocated or over-allocated. When inland communities are evaluating potential sources for new water supplies, desalination is often overlooked or not considered due to its perceived high cost. A major cost factor is the additional handling, disposal and/or treatment required to manage concentrate streams. Further, in the disposal of concentrate, significant and desirable additional water resources are also lost. Reclamation sought innovative solutions for reducing the volume of concentrate requiring disposal from inland desalination systems in an affordable, environmentally sustainable, and efficient manner to make desalination an attractive option relative to other alternatives in locations where traditional sources of water are inadequate. Solutions can be novel technologies or approaches which build upon existing technologies. This multi-phase competition spanned over the two years. Participants developed their concepts on paper, developed their prototypes, and participated in the final phase of the competition to test their prototype technology as part of a demonstration event at Reclamation's Yuma Desalting Plant in Yuma, Arizona.

Advancement of Agency Mission: The More Water Less Concentrate competition spurred more innovative approaches to inland brackish desalination which can result in the production of more usable water and less concentrate requiring additional treatment or disposal. Solutions that reduce the volume of concentrate requiring disposal from inland desalination systems in an affordable, environmentally sustainable, and efficient manner can make desalination an attractive option over alternatives in locations where traditional sources of water are inadequate.

Plan for Upcoming Two Fiscal Years: Reclamation plans to continue identifying topics and plan for future competitions to address infrastructure, advanced water treatment, water availability, and environment where advancement or resolution of issues can contribute to Reclamation carrying out its mission more effectively or efficiently. Reclamation will continue to explore completed competition outcomes to determine pathways for potential further development, testing (lab or field), and potential implementation.

B.5.8. Rust Busters[158]

Sponsoring Agency and Office: Bureau of Reclamation

Authority: Procurement

Competition Summary: Water infrastructure in the United States is critical to the domestic economy, commerce, and resource management. Hydraulic steel structures (HSS) require regular maintenance

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[157] The website for More Water Less Concentrate is accessible at https://www.usbr.gov/research/challenges/morewater.html; https://www.morewaterlessconcentrate.org/.

[158] The website for Rust Busters is accessible at https://www.usbr.gov/research/challenges/corrosion.html; https://www.herox.com/RustBusters.

and upkeep. Existing methods to protect HSS are disfavored or no longer used due to environmental and safety concerns. Newer methods often have higher costs, shorter service life, and reduced efficacy. To address rising maintenance costs and to advance the state of the art for corrosion control, the Bureau of Reclamation (Reclamation), in collaboration with the U.S. Army Corps of Engineers (USACE), launched the Rust Busters Challenge. Rust Busters sought new methods for corrosion control outside of the conventional approaches that can be applied to existing structures in situ or advances existing technologies, would significantly improve service life, reduce costs (through innovative application methods or use of new materials), or improve performance range (through additional features such as health monitoring or self-healing). Rust Busters offered the opportunity for the most compelling corrosion control approaches to be evaluated and field-tested by the Challenge sponsors. In Phase 1, participants submitted papers detailing their proposed approach to corrosion control, its scientific rationale, and supporting data. Five of the most compelling submissions were selected as Phase 1 winners and invited to participate in Phase 2. During Phase 2, participants demonstrated their technologies using test coupons, steel samples, supplied by Reclamation. Test coupons and/or prototypes were evaluated by Reclamation in the lab using methods to accelerate erosion and weathering. Complex steel coupons were deployed from the dam face in Lake Havasu at Parker Dam, California. Prototypes were periodically evaluated during the seven months submersion period.

Advancement of Agency Mission: Water infrastructure in the United States is critical to the domestic economy, commerce, and resource management. There are thousands of existing hydraulic steel structures (HSS) that require regular maintenance and upkeep. Original methods to protect HSS are disfavored or no longer used due to environmental and safety concerns. Newer approaches to corrosion control suffer from higher costs, shorter service life, and reduced efficacy. Improved technologies or methods will support Reclamation in its mission to economically operate and maintain our water and power facilities.

Plan for Upcoming Two Fiscal Years: Reclamation plans to continue identifying topics and plan for future competitions to address infrastructure, advanced water treatment, water availability, and environment where advancement or resolution of issues can contribute to Reclamation carrying out its mission more effectively or efficiently. Reclamation will continue to explore completed competition outcomes to determine pathways for potential further development, testing (lab or field), and potential implementation.

B.5.9. Snowcast Showdown[159]

Sponsoring Agency and Office: Bureau of Reclamation

Authority: Procurement

Competition Summary: Water resources managers rely on measurements and estimates of snow water equivalent (SWE) to as inputs to streamflow and water supply forecasts, which in turn support a variety of water management decisions including managing reservoir storage levels, setting water allocations, and planning for extreme events. SWE is currently measured at discrete measurement sites using ground-based instruments or estimated based on airborne remote sensing. Ground-based measurements provide high accuracy and high temporal resolution, but have very sparse spatial coverage; current airborne methods provide complete spatial coverage over flown areas, but are flown

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[159] The website for Snowcast Showdown is accessible at https://www.usbr.gov/research/swe/index.html; https://www.drivendata.org/competitions/90/competition-reclamation-snow-water/.

over limited areas and have sparse temporal coverage. High resolution satellite imagery offers promising opportunities to improve snow monitoring—using satellite imagery to estimate SWE remains an active research area. This competition focused on applying machine learning methods that provide flexible and efficient algorithms for data-driven models and real-time prediction to improve estimation of the spatial distribution of SWE over the western US. The competition had two tracks: Track 1: Prediction Competition where competitors developed and trained machine learning models to estimate the current spatial distribution of SWE over the West. Models were executed on a weekly basis to generate near real-time estimates of SWE throughout the winter and spring seasons. Models were evaluated against ground truth data, and prizes were awarded based on model performance. Track 2: Model Report Competition where competitors submitted additional documentation of their models. Documentation included additional model analysis and discussion of solution methodology, including detailed discussion of the robustness and interpretability.

Advancement of Agency Mission: Water resource managers use measurements and estimates of the amount of water stored in a snowpack (SWE) for streamflow and water supply forecasts, which then informs a wide range of management decisions, including managing reservoir storage levels, setting seasonal water allocations, and responding to extreme weather events such as floods and droughts.

Plan for Upcoming Two Fiscal Years: Reclamation plans to continue identifying topics and plan for future competitions to address infrastructure, advanced water treatment, water availability, and environment where advancement or resolution of issues can contribute to Reclamation carrying out its mission more effectively or efficiently. Reclamation will continue to explore completed competition outcomes to determine pathways for potential further development, testing (lab or field), and potential implementation.

B.5.10.   Streamflow Forecast Rodeo[160]

Sponsoring Agency and Office: Bureau of Reclamation

Authority: Procurement

Competition Summary: Streamflow forecasting is integral to water management, and with higher skill forecasts water managers are better equipped to operate facilities for high flows, mitigate impacts of drought, and achieve other improved outcomes like hydropower generation. The Streamflow Forecast Rodeo sought to improve the skill of short-term streamflow forecasts (10 days) via a year-long competition. Solvers developed and implemented their methods for locations across the western United States with the goal of outperforming state-of-practice streamflow forecasts. With this approach, Reclamation aimed to spur innovation using data science communities and Artificial Intelligence (AI)/Machine Learning (ML) methods toward enhancing streamflow forecasts. Prior to the start of the year-long competition, teams were provided the opportunity to participate in a pre-season to build and refine their forecasting systems. This helped generate interest in the real-time competition and better position teams to compete with the state-of-practice forecasts. The year-long real-time competition kicked off in late September 2020 and ran through September 2021. The competition was a success in that participants produced short-term streamflow forecasts (10 days) with skill scores

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[160]   The   website   for   Streamflow   Forecast   Rodeo   is   accessible   at https://www.usbr.gov/research/challenges/streamflowrodeo.html; https://www.topcoder.com/community/streamflow.

higher than the state-of-practice methods. Participants competed against benchmark, state-of-practice forecasts.

Advancement of Agency Mission: Techniques that outperform current forecast practices are expected to offer valuable insight as to how operational forecasts may be improved. This in turn can provide water managers much needed information to better operate water and power facilities, manage resources, and prepare for extreme events.

Plan for Upcoming Two Fiscal Years: Reclamation plans to continue identifying topics and plan for future competitions to address infrastructure, advanced water treatment, water availability, and environment where advancement or resolution of issues can contribute to Reclamation carrying out its mission more effectively or efficiently. Reclamation will continue to explore completed competition outcomes to determine pathways for potential further development, testing (lab or field), and potential implementation.

B.5.11. Theodore Roosevelt Genius Prize for the Management of Invasive Species[161]

Sponsoring Agency and Office: United States Fish and Wildlife Service

Authority: John D. Dingell, Jr., Conservation, Management, and Recreation Act, March 12, 2019 (Public Law 116-9)

Competition Summary: Invasive species cause tremendous harm to our environment, economy, and health. Invasive species can include animals, plants, fish, wildlife pathogens, and diseases. When invasive species eat, crowd out, or otherwise affect native species, they can reduce biological diversity. Ecosystems with low biodiversity are more vulnerable to disease, climate change, and other environmental stresses. At worst, invasive species can lead to the extinction of native species. Invasive species also reduce recreational opportunities and inflict costly damage on infrastructure, such as roads, canals, and levees. Many invasive species are spread or introduced accidentally (e.g., on the hulls of boats or soles of shoes). Some are purposely acquired as pets or garden trees or flowers that end up in the wild. Invasive fish and wildlife can prey on native species and outcompete them for food and habitat. Invasive plants can outcompete native vegetation for space, moisture, sunlight, and soil nutrients. The goal of this challenge focused on finding innovations that help land managers directly reduce the spread and impacts of invasive species within the United States and its Territories. In FY 22 the Service, in collaboration with the National Fish and Wildlife Foundation, launched the first series of TR Genius Prize competitions aimed to jumpstart awareness of and activities to manage invasive species and stimulate interest in the conservation need for potential partnerships to further develop innovative solutions.

Advancement of Agency Mission: The Service's mission is to work with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people. New or improved techniques to reduce the abundance and impacts of invasive species is paramount to the Service's mission.

Plan for Upcoming Two Fiscal Years: FY 2023 - 2024 Service Plans for Prize Competitions The Service plans to continue identifying topics and plan for another round of prize competitions to address the six

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[161] The website for Theodore Roosevelt Genius Prize for the Management of Invasive Species is accessible at https://www.fws.gov/service/theodore-roosevelt-genius-prize-competitions.

focus areas identified in the TR Genius Prize Program: Prevention of Wildlife Poaching and Trafficking, Protection of Endangered Species, Management of Invasive Species, Management of Nonlethal Human-Wildlife Conflict, Promotion of Wildlife Conservation, and Reduction of Human-Predator Conflict.

B.5.12. Theodore Roosevelt Genius Prize for the Management of Nonlethal Human-Wildlife Conflict[162]

Sponsoring Agency and Office: United States Fish and Wildlife Service

Authority: John D. Dingell, Jr., Conservation, Management, and Recreation Act, March 12, 2019 (Public Law 116-9)

Competition Summary: Human-wildlife conflict is increasing as human populations expand. Climate change continues to exacerbate human wildlife overlap and competition. This conflict is exhibited in many forms including livestock predation, human safety, recreation/sporting activities, companion animal safety, development, transportation safety, wildlife crossing safety, home/yard nuisance, and gardening/agricultural losses. Historically, lethal means of controlling wildlife populations or removing specific individuals were broadly employed. However, such practices are becoming increasingly unpalatable given their many negative impacts (ecological, safety, financial, spiritual, etc.). Furthermore, human-animal compassion is growing across America such that many aspects of our culture are becoming less tolerant of lethal means for controlling wildlife. Human-wildlife conflict is a large and widespread conservation problem. The goal of this challenge focused on solutions that facilitate human-wildlife coexistence and/or ways to proactively deterring human-wildlife conflict. Human-wildlife conflict frequently occurs within or adjacent to population centers in both rural and urban areas. The increasing encroachment into the wildland-urban interface from population increase and the effects of climate change increasingly results in human-wildlife conflict to varying degrees. Wildlife conservation efforts also necessitate innovation in nonlethal human-wildlife conflict management so that progress continues. In FY2022 the Service, in collaboration with the National Fish and Wildlife Foundation, launched the first series of TR Genius Prize competitions aimed to jumpstart awareness of and activities to manage human-wildlife conflict and stimulate interest in the conservation need for potential partnerships to further develop innovative solutions.

Advancement of Agency Mission: The Service's mission is to work with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people. Working to promote coexistence and prevent or mitigate human-wildlife conflict, is a complex and contentious management challenge. Persistence of many species at any significant scale in the contiguous United States will depend on our ability to coexist with them. And since many, die from anthropogenic causes, there is general agreement that their conservation hinges on our ability to share the landscape with them. On-the-ground resources and approaches exist for minimizing human conflicts, but more innovation is needed to improve upon them. New or improved techniques to manage nonlethal human-wildlife conflict are paramount to the Service's mission.

Plan for Upcoming Two Fiscal Years: The Service plans to continue identifying topics and plan for another round of prize competitions to address the six focus areas identified in the TR Genius Prize Program: Prevention of Wildlife Poaching and Trafficking, Protection of Endangered Species,

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[162] The website for Theodore Roosevelt Genius Prize for the Management of Nonlethal Human-Wildlife Conflict is accessible at https://www.fws.gov/service/theodore-roosevelt-genius-prize-competitions.

Management of Invasive Species, Management of Nonlethal Human-Wildlife Conflict, Promotion of Wildlife Conservation, and Reduction of Human-Predator Conflict.

B.5.13. Theodore Roosevelt Genius Prize for the Prevention of Wildlife Poaching and Trafficking[163]

Sponsoring Agency and Office: United States Fish and Wildlife Service

Authority: John D. Dingell, Jr., Conservation, Management, and Recreation Act, March 12, 2019 (Public Law 116-9)

Competition Summary: Wildlife trafficking undermines effective conservation efforts; these crimes are major drivers of species declines and there is no ecosystem in the world that has avoided negative impacts. Wildlife trafficking can be associated with violence against animals and people, destabilization of communities and undermining of local governance, inhumane transshipment methods, high mortality rates, substandard care, and increased susceptibility to disease. When ecosystems lose fauna and flora to the illegal wildlife trade, the ecosystem suffers from degraded integrity and function and individual populations can be extinguished. When illegally traded wildlife enter new ecosystems, they can spread disease and establish themselves as invasive. Wildlife trafficking is a large and widespread conservation problem. The goal of this challenge focused on addressing the issue of wildlife trafficking in the United States and its Territories (as a source, transit, or destination geography) through one or both of these high-priority focal areas: the lack of effective and efficient methods for detection, rehabilitation, and/or release of live animals in the illegal trade and knowledge sharing for appropriate law enforcement authorities. The Service's interest is in technology that would aid authorities in prevention, detection, and identification of poached and trafficked wildlife. In FY22, the Service, in collaboration with the National Fish and Wildlife Foundation, launched the first series of TR Genius Prize competitions aimed to jumpstart awareness of and activities to prevent wildlife poaching and trafficking and stimulate interest in the conservation need for potential partnerships to further develop innovative solutions.

Advancement of Agency Mission: Evaluation panels are used for the competition. Panels include a mix Federal and non-Federal subject matter experts and would-be end users of the solutions proposed. Evaluation panels provide quantitative scores based upon preestablished criteria for the solutions based upon specific criteria. Qualitative evaluation is also provided based on panel member knowledge and experience. Submission scores and qualitative evaluations are discussed by the evaluation panel and final evaluations provided for selecting the final winner.

Plan for Upcoming Two Fiscal Years: The Service plans to continue identifying topics and plan for another round of prize competitions to address the six focus areas identified in the TR Genius Prize Program: Prevention of Wildlife Poaching and Trafficking, Protection of Endangered Species, Management of Invasive Species, Management of Nonlethal Human-Wildlife Conflict, Promotion of Wildlife Conservation, and Reduction of Human-Predator Conflict.

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[163] The website for Theodore Roosevelt Genius Prize for the Prevention of Wildlife Poaching and Trafficking is accessible at https://www.fws.gov/service/theodore-roosevelt-genius-prize-competitions.

B.5.14. Theodore Roosevelt Genius Prize for the Promotion of Wildlife Conservation[164]

Sponsoring Agency and Office: United States Fish and Wildlife Service

Authority: John D. Dingell, Jr., Conservation, Management, and Recreation Act, March 12, 2019 (Public Law 116-9)

Competition Summary: All human lives and livelihoods are inherently integrated with the health of the planet and its biodiversity. Currently, more than 80% of the American public live in urban areas, and as a result they are too often disconnected from wildlife or conservation efforts. Additionally, the increasingly diverse American public has a range of wildlife values and expectations for engagement with wildlife. Therefore, promoting wildlife conservation in ways that appeal to some groups may serve to alienate others. A visionary way to make wildlife conservation relevant to all American people could go far in rallying a unified national effort to save wild species and their habitats.

Advancement of Agency Mission: The Service's mission is to work with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people. Finding solutions that address a visionary way to make wildlife conservation relevant to all American people. New or improved technology innovations to promote wildlife conservation and address visionary ways of making wildlife conservation relevant to all American's is paramount to the Service's mission.

Plan for Upcoming Two Fiscal Years: The Service plans to continue identifying topics and plan for another round of prize competitions to address the six focus areas identified in the TR Genius Prize Program: Prevention of Wildlife Poaching and Trafficking, Protection of Endangered Species, Management of Invasive Species, Management of Nonlethal Human-Wildlife Conflict, Promotion of Wildlife Conservation, and Reduction of Human-Predator Conflict.

B.5.15. Theodore Roosevelt Genius Prize for the Protection of Endangered Species[165]

Sponsoring Agency and Office: United States Fish and Wildlife Service

Authority: John D. Dingell, Jr., Conservation, Management, and Recreation Act, March 12, 2019 (Public Law 116-9)

Competition Summary: Once a species is determined to meet the definition of an endangered species under the Endangered Species Act, additional protection in the form of management intervention to prevent additional population decline, loss in genetic variation, and address exposure to existing or new threats is often needed. Conservation actions carried out in the United States under the Act have been successful in preventing extinction for 99 percent of the species that have been listed as endangered or threatened. However, species loss on a global scale continues to increase due to the environmental effects of human activities. Habitat loss and degradation is the most widespread cause of species endangerment in the United States, affecting approximately 85 percent of imperiled species.

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[164] The website for Theodore Roosevelt Genius Prize for the Promotion of Wildlife Conservation is accessible at https://www.fws.gov/service/theodore-roosevelt-genius-prize-competitions.

[165] The website for Theodore Roosevelt Genius Prize for the Protection of Endangered Species is accessible at https://www.fws.gov/service/theodore-roosevelt-genius-prize-competitions.

Habitat loss in turn negatively affects population sizes and reproductive success. The Florida panther (Puma concolor coryi) is an example of a subspecies that was placed on the Endangered Species list due to habitat fragmentation and degradation. The Florida panther once ranged throughout the southeast United States but due to urbanization, it now survives in a small area of south Florida representing just 5 percent of its original range. Survival is further threatened from vehicle collisions. Another example of an endangered species threatened by habitat loss is the Great Lakes population of piping plover (Charadrius melodus). Human disturbance and predators affect nesting and fledging success. The goal of this challenge is to solicit focused solutions that promote the long-term recovery of endangered species populations by addressing recruitment or survival due to habitat degradation or loss. The Service's interest is in new technology innovations that promote recruitment and recovery of endangered species within the United States and its Territories.

Advancement of Agency Mission: The mission of the Fish and Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. New or improved innovations that help to protect and recover endangered species through addressing habitat degradation or loss is paramount to the Service's mission.

Plan for Upcoming Two Fiscal Years: The Service plans to continue identifying topics and plan for another round of prize competitions to address the six focus areas identified in the TR Genius Prize Program: Prevention of Wildlife Poaching and Trafficking, Protection of Endangered Species, Management of Invasive Species, Management of Nonlethal Human-Wildlife Conflict, Promotion of Wildlife Conservation, and Reduction of Human-Predator Conflict.

B.5.16. Theodore Roosevelt Genius Prize for the Reduction of Human-Predator Conflict[166]

Sponsoring Agency and Office: United States Fish and Wildlife Service

Authority: John D. Dingell, Jr., Conservation, Management, and Recreation Act, March 12, 2019 (Public Law 116-9)

Competition Summary: Predators have an essential role in resilient ecosystem function. Healthy predator populations help regulate prey populations that otherwise can overpopulate, damage native ecosystems, and spread disease. Conflicts between predators and humans can occur in many ways, for example, predation of livestock, damage to property, agriculture, and pets. Additionally, recreationists can encounter human-predator conflicts that can be life-threatening. For many predator species, conflict with people can threaten their survival in the wild. Predator deterrents such as livestock guardian dogs, lighting, and noise devices have successfully minimized human-predator conflicts, but they have not yet been widely adopted. The goal of this challenge focused on technology innovations that reduce human-predator conflicts and significantly reducing or eliminating stakeholder obstacles. Stakeholder obstacles are those challenges that might prevent the solution from being readily adopted and used by stakeholders. On-the-ground resources and approaches – from livestock husbandry to agency-level management – exist for minimizing human conflicts with large carnivores, but the Service is interested in new innovations to improve upon them. In FY 2022 the Service, in collaboration with the National Fish and Wildlife Foundation, launched the first series of TR Genius Prize competitions aimed

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[166] The website for Theodore Roosevelt Genius Prize for the Reduction of Human-Predator Conflict is accessible at https://www.fws.gov/service/theodore-roosevelt-genius-prize-competitions.

to jumpstart awareness of and activities to reduce human-predator conflict and stimulate interest in the conservation need for potential partnerships to further develop innovative solutions.

Advancement of Agency Mission: The Service's mission is to work with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people. Wolves, grizzly bears, and cougars are symbolic, high-profile, predatory animals. Working to promote coexistence and prevent or mitigate human-wildlife conflict, is a complex and contentious management challenge. Persistence of grizzlies, cougars, and wolves at any significant scale in the contiguous United States will depend on our ability to coexist with them. And since many, perhaps most, large carnivores die from anthropogenic causes, there is general agreement that their conservation hinges on our ability to share the landscape with them. On-the-ground resources and approaches – from livestock husbandry to agency-level management - exist for minimizing human conflicts with large carnivores, but more innovation is needed to improve upon them. New or improved techniques to reducing human-predator conflict are paramount to the Service's mission.

Plan for Upcoming Two Fiscal Years: The Service plans to continue identifying topics and plan for another round of prize competitions to address the six focus areas identified in the TR Genius Prize Program: Prevention of Wildlife Poaching and Trafficking, Protection of Endangered Species, Management of Invasive Species, Management of Nonlethal Human-Wildlife Conflict, Promotion of Wildlife Conservation, and Reduction of Human-Predator Conflict.

B.5.17. Water America s Crops[167]

Sponsoring Agency and Office: Bureau of Reclamation

Authority: Procurement

Competition Summary: As the nation's largest wholesale water supplier, the Bureau of Reclamation provides irrigation water for 10 million acres of farmland that produce 60 percent of the nation's vegetables and 25 percent of its fresh fruit and nuts. To supply the needed water, Reclamation maintains and operates over 8,000 miles of water distribution systems that use, among other means, reservoirs and canals to store and deliver water. Water lost due to seepage reduces the efficiency of the water delivery to the users and can cause undermining/erosion, subgrade soil migration, adverse vegetation growth, and even canal failure. To reduce water seepage, linings consisting of materials such as compacted clay, concrete, geosynthetics (e.g., HDPE, PP, PVC, EPDM), and bituminous fabrics have been installed in some canals. Though canal linings can significantly reduce seepage, installation and ongoing maintenance can be cost prohibitive. In addition, linings may be subject to leakage given damage from UV exposure, weather exposure, floating/dumped debris, animal traffic, tree root penetrations, soil chemistry, loss of mechanical properties (e.g., concrete cracking), etc. This Water America's Crops Challenge seeks innovative solutions that can reduce the costs and burdens associated with installation and maintenance of seepage reduction methods and improve durability in a range of climatic conditions. This prototyping competition is envisioned to consist of 2 main stages comprising a white paper submission followed by a laboratory-scale demonstration.

Advancement of Agency Mission: As water is conveyed by a canal from the source to customers, some water losses (such as from evaporation) are inevitable. However, a much more significant and

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[167] The website for Water America s Crops is accessible at https://www.usbr.gov/research/challenges/watercrops.html; https://www.herox.com/WaterAmericasCrops.

preventable type of loss is seepage of water from a canal into the ground. Improving technologies to address canal seepage will reduce water loss in canals, improve the efficiency of water deliveries and decrease costs for Reclamation and its customers. Moreover, a successful outcome of this competition can reduce the risk of canal failure due to seepage over the long term.

Plan for Upcoming Two Fiscal Years: Reclamation plans to continue identifying topics and plan for future competitions to address infrastructure, advanced water treatment, water availability, and environment where advancement or resolution of issues can contribute to Reclamation carrying out its mission more effectively or efficiently. Reclamation will continue to explore completed competition outcomes to determine pathways for potential further development, testing (lab or field), and potential implementation.

B.6.   Environmental Protection Agency (EPA)

B.6.1. Campus Rainworks Challenge[168]

Sponsoring Agency and Office: Office of Water

Authority: Clean Water Act Section 104

Competition Summary: The Campus RainWorks Challenge is a green infrastructure design competition for American colleges and universities that seeks to engage with the next generation of environmental professionals, foster a dialogue about the need for innovative stormwater management techniques, and showcase the environmental, economic, and social benefits of green infrastructure practices. EPA sponsors the Challenge because stormwater runoff is a significant source of water pollution in communities across the United States, and the Challenge invites students to be part of the solution today and in the future. Since 2011, Campus RainWorks has engaged over 800 multi-disciplinary teams from over 270 US colleges and universities in 48 states; expanded to allow designs for schoolyards; and honed student communication skills in the social media age by requiring video pitches. To mark the 10th anniversary of the Challenge, EPA provided direct technical assistance to two campuses—Morgan State University and University of Texas at Arlington—to advance green infrastructure efforts on the campuses; help develop resource for campuses nationwide; and inform future rounds of the Challenge.

Advancement of Agency Mission: Campus RainWorks advances Agency mission by educating future professionals on the benefits of green infrastructure as a means to address environmental, economic and social issues concerning a community. Specifically, green infrastructure practices provide a flexible solution to managing stormwater runoff by improving water quality and reducing quantity of runoff that can lead to flooding and erosion to receiving streams.

Plan for Upcoming Two Fiscal Years: EPA launched the 11th Campus RainWorks in August of 2023

B.6.2. EcoTox TARGET Challenge[169]

Sponsoring Agency and Office: Office of Research and Development

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[168] The website for Campus Rainworks Challenge is accessible at https://www.epa.gov/green-infrastructure/campus-rainworks-challenge-0.

[169] The website for EcoTox TARGET Challenge is accessible at https://www.epa.gov/innovation/ecotox-target-challenge.

Authority: FIFRA Sect 20; Clean Water Act 104, Toxic Substances Control Act Section 15

Competition Summary: The EcoTox TARGET Challenge asked Solvers to develop and demonstrate high quality, low cost, technologies for measuring global gene expression in samples from non-human organisms including fish, invertebrates, and plants/algae. The analysis platforms developed are intended to serve as a foundation for the next generation of high throughput ecological toxicity tests for use in environmental safety evaluation of chemicals. The Challenge was sponsored by US EPA's Office of Research and Development. It was developed in partnership with the US Army Engineer Research and Development Center, Environment and Climate Change Canada, the European Commission Joint Research Center, Dow, and Syngenta. Solvers demonstrated the performance by analyzing a set of 36 Reference samples provided by the Sponsors. The reference samples, derived from four different species, were designed in a manner that allowed evaluation of precision and accuracy of data generated. Additionally, Solvers submitted a technical description document providing details regarding the theory and technology behind their platform, quality assurance/control, estimated per sample cost and other information to establish the viability of their Solution to process 1000s to 10,000s, of samples per year in support of high throughput testing. Seven Solver teams registered for the competition. Over the course of the Challenge, which ran concurrent with the Covid-19 pandemic, three Solvers dropped out of the competition, citing pandemic-related disruptions to their operations. One Solver did not respond to communications and did not submit a Solution. The remaining three Solver teams submitted a total of five independent Solutions for evaluation. A panel of seven judges, declaring no conflicts of interest, evaluated the Solutions based on judging criteria defined and published prior to the start of the Challenge. Based on their evaluation, one organization was selected to receive the single $300,000 cash award.

Advancement of Agency Mission: The analysis technologies/platforms demonstrated by the Solver teams are now being used as part of ORD ecological high throughput toxicology research program. Samples have already been provided to the winning Solver, Biospyder, for analyses in support of EPA's PFAS research as well as Great Lakes Restoration Initiative (GLRI). Additionally, some of the novel kits and reagents employed by the other Solvers are being tested by ORD for potential use.

Plan for Upcoming Two Fiscal Years: None reported

B.6.3. EmPOWER Air Data Challenge[170]

Sponsoring Agency and Office: Office of Air and Radiation

Authority: Clean Air Act

Competition Summary: The EmPOWER Air Data Challenge, hosted by EPA's Clean Air Markets Division (CAMD), invites universities and think-tanks to develop innovative and creative uses of CAMD's emissions and environmental monitoring data. Potential project themes include analyzing data, enhancing communications, developing apps and data mashups, promoting environmental education, and improving data quality. Winners of the challenge are assigned a CAMD staff expert for technical assistance in retrieving and understanding the data. Winners also receive recognition for their work by being featured on the EmPOWER Air Data Challenge website, present their work to EPA staff, and have the opportunity to network with fellow winners EPA and non-EPA experts.

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[170] The website for EmPOWER Air Data Challenge is accessible at https://www.epa.gov/airmarkets/empower-air-data-challenge.

Advancement of Agency Mission: The EmPOWER Air Data Challenge helps EPA advance its mission of protecting human health and the environment by increasing awareness and understanding of environmental data and engaging the research community, who provide important insights into environmental problems. In addition, EPA has a responsibility to the public to make these data accessible to a variety of stakeholders, and challenge winners have provided invaluable feedback as EPA seeks to improve the materials and tools for accessing these data.

Plan for Upcoming Two Fiscal Years: None reported

B.6.4. Environmental Justice Student Video Challenge[171]

Sponsoring Agency and Office: Office of Research and Development; Office of Environmental Justice and External Civil Rights (OEJECR)

Authority: Clean Water Act 33 USC 1254(a) and (b), Clean Air Act 42 USC 7403(a), Solid Waste Disposal Act 42 USC 6981, and National Environmental Policy Act 102(2)(F)

Competition Summary: Many communities face greater environmental exposures and public health risks due to a history of inequitable environmental policies and access to the decision-making process. Environmental justice (EJ) is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EPA and co-sponsors launched the Environmental Justice (EJ) Video Challenge for Students to enhance communities' capacity to address environmental and public health inequities. The goals of the challenge are to inspire students at accredited colleges and universities in the United States and its territories to work directly with communities in the identification and characterization of EJ challenges using data and publicly available tools, and to help communities (including residents and other stakeholders) address EJ challenges and/or vulnerabilities to environmental and public health hazards using data and publicly available tools.

Advancement of Agency Mission: EPA's mission is to protect human health and the environment, and EPA's goal is to provide an environment where all people enjoy the same degree of protection from environmental and health hazards and equal access to the decision-making process to maintain a healthy environment in which to live, learn, and work. The results from this challenge aim to enhance community capacity including increased knowledge about local environmental justice (EJ) issues and proposed strategies to address the EJ issues. It is the hope that this information will help communities to position themselves to better address the identified EJ issue thus helping to protect their health and environment. Additionally, the use of EPA tools will be shared with tool developers to inform them of how the public utilized their tools. This information could help tool developers to improve their tools in future versions that may benefit local communities.

Plan for Upcoming Two Fiscal Years: N/A

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[171] The website for Environmental Justice Student Video Challenge is accessible at https://www.epa.gov/innovation/environmental-justice-video-challenge-students.

B.6.5. Make a Market Tech Challenge[172]

Sponsoring Agency and Office: Office of Research and Development

Authority: Clean Water Act, Clean Air Act, Safe Drinking Water Act

Competition Summary: EPA conducts critical research in its laboratories and centers to address environmental issues. Not only does this research help advance the understanding of environmental science, but it also creates inventions that benefit human health and the environment. EPA's technology transfer team, the Federal Technology Transfer Act (FTTA) team, plays a vital role in finding licensees for EPA's inventions. Technology transfer ensures that the novel technologies invented by EPA scientists successfully transition from the laboratory to commercially available products or services. Finding a commercial partner is vital to mature the invention so that it can impact the lives of citizens. The FTTA team uses market assessments to find commercial partners to further develop and sell the inventions. Market assessments allow the EPA to assess the industry and provide information on the market sectors where a technology fits best. They often include an overview of the industry and its players, information about the invention fit within the industry, and information about potential partners for product development. EPA launched the Make a Market Tech Challenge to solicit innovative market assessments of new technologies developed by EPA researchers. The challenge asks university and college student teams or individual participants to choose one of five patented EPA technologies and develop a market assessment for the selected technology.

Advancement of Agency Mission: This challenge will help the EPA obtain information on the broader market of technology, the targeted end users, and potential industry licensees, which is valuable information to the FTTA staff when trying to license technologies to companies. It will also provide valuable information to the Centers so they can make informed decisions about ongoing maintenance costs to keep these patents active.

Plan for Upcoming Two Fiscal Years: Judging began in January 2023 and prizes were awarded in spring 2023.

B.6.6. See a Bloom, Give It Room: Urban Waters Edition Challenge[173]

Sponsoring Agency and Office: Region 7 - Kansas City

Authority: Clean Water Act Section 303

Competition Summary: 2021 Harmful Algal Bloom (HAB) Challenge: EPA Region 7 announced the launch of the 2021 "See a Bloom, Give It Room" Video Challenge. The theme for the competition was urban waters located in the Kansas City, Missouri, metropolitan area. This competition is supported by EPA's Office of Research and Development, and calls for videos that promote public awareness of harmful algal blooms through creative filmmaking.

Advancement of Agency Mission: Used video submissions for education awareness via social media posts.

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[172] The website for Make a Market Tech Challenge is accessible at https://www.epa.gov/innovation/make-market-tech-challenge https://www.challenge.gov/?challenge=ftta-make-a-market-tech-challenge.

[173] The website for See a Bloom, Give It Room: Urban Waters Edition Challenge is accessible at https://www.epa.gov/newsreleases/epa-region-7-launches-2021-see-bloom-give-it-room-urban-waters-edition-video-challenge.

Plan for Upcoming Two Fiscal Years: N/A

B.6.7. Water Toxicity Sensor Challenge[174]

Sponsoring Agency and Office: Office of Research and Development

Authority: Section 1442 of the Safe Drinking Water Act, 42 U.S.C. § 300j-1 Section 104 of the Clean Water Act, 33 U.S.C. § 1254

Competition Summary: Monitoring the increasing number of pollutants in source waters is an ongoing concern for water treatment systems and water resource managers. Current methods for detecting and identifying many of these contaminants are expensive, time-consuming, and require the use of specialized laboratories. In addition, the numbers of sensors, instruments, tests, labs, personnel, and other costs can become an economic burden for water resource managers. To meet the need for better ways to monitor toxicity in water, EPA, along with several partners, launched the Water Toxicity Sensor Challenge. This ideation challenge called on innovators to propose a sensor design that would allow for the detection of chemical pollutants and/or natural toxins in water, based on the sensor's ability to detect the activation of one or more cellular toxicity pathways.

Advancement of Agency Mission: The purpose of this successful ideation challenge was two-fold: first, to encourage the sharing of concepts to develop a more effective water quality sensor, and second, to determine if the field was sufficiently advanced to justify a prototype challenge. In the long-run, this effort encourages the development of more effective tools to evaluate water quality and would aid the Agency's objective of ensuring safe water.

Plan for Upcoming Two Fiscal Years: A follow-on "prototype" challenge, asking solvers to develop a novel toxicity sensor, launched in early 2023.

B.7. Executive Office of the President of the United States (EOP)

B.7.1. The Time is Now: Advancing Equity in Science & Technology Ideation Challenge[175]

Sponsoring Agency and Office: Office of Science and Technology Policy

Authority: NA

Competition Summary: The OSTP Time is Now Challenge gave all people, from students and skilled technical workers, scientists, and industry innovators, to equity advocates, creatives, education leaders, and the people who value and use science and technology in their everyday lives, the opportunity to help answer the question "how can we guarantee all Americans can fully participate in, and contribute to, science and technology?" by directly submitting their own thoughts, ideas, or examples of existing or promising actions that expand equity and inclusion. The ideation challenge was designed to gather critical input from the public as part of a larger effort to gather ideas that can galvanize action and spur new efforts that benefit the entire Nation.

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[174] The website for Water Toxicity Sensor Challenge is accessible at https://www.epa.gov/innovation/winners-water-toxicity-sensor-challenge-phase-1.

[175] There was no website provided for The Time is Now: Advancing Equity in Science & Technology Ideation Challenge.

Advancement of Agency Mission: The results of the challenge informed the White House Office of Science and Technology Policy's "Vision to Transform and Enhance the U.S. STEMM Ecosystem" (https://www.whitehouse.gov/ostp/news-updates/2022/12/12/equity-and-excellence-a-vision-to-transform-and-enhance-the-u-s-stemm-ecosystem/). The national vision for STEMM equity and excellence calls for bold concerted leadership, focusing our national efforts and synchronizing cross-sector initiatives across five core action areas and each action area proposes promising practices.

Plan for Upcoming Two Fiscal Years: None reported

B.8.   Federal Deposit Insurance Corporation (FDIC)

B.8.1. Breaking Down Barriers: Reaching the Last Mile of the Unbanked[176]

Sponsoring Agency and Office: NA

Authority: Federal Deposit Insurance Act

Competition Summary: In October 2020, the FDIC published How America Banks, the agency's latest biennial survey of household use of banking and financial services. This study found that while nearly 95 percent of U.S. households were banked (i.e., had a bank or credit union account), more than seven million households were unbanked. Black, Hispanic, and American Indian or Alaska Native households remain significantly more likely to be unbanked. Given the challenges reaching the "last mile" of unbanked households, the FDIC held a tech sprint focused on the following problem statement: "which data, tools, and other resources could help community banks meet the needs of the unbanked population in a cost-effective manner, and how might the impact of this work be measured?" Eight teams presented solutions.

Advancement of Agency Mission: The FDIC sought diverse, innovative, and equitable solutions to reach the "last mile" of the unbanked or underbanked. Knowledge gained in reviewing proposed solutions may inform future FDIC decisions.

Plan for Upcoming Two Fiscal Years: The FDIC does not currently plan to conduct prize competitions in FY23 and FY24.

B.8.2. From Hurricanes to Ransomware: Measuring Resilience in the Banking World[177]

Sponsoring Agency and Office: NA

Authority: Federal Deposit Insurance Act

Competition Summary: The FDIC held a tech sprint titled "From Hurricanes to Ransomware: Measuring Resilience in the Banking World" from October 4, 2021 - October 22, 2021. Over the past decade, the U.S. financial sector has faced a growing number of threats to its information technology systems, operations, people, and facilities. Regardless of whether the threats to financial institutions and their third-party service providers are foreign or domestic, intended or unintended, or natural or man-made, preparedness and improved response posture are critical to improving overall sector-wide operational

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[176] The website for Breaking Down Barriers: Reaching the Last Mile of the Unbanked is accessible at https://www.fdic.gov/fditech/techsprints/breaking-barriers.html.

[177] The website for From Hurricanes to Ransomware: Measuring Resilience in the Banking World is accessible at https://www.fdic.gov/fditech/techsprints/measuring-resilience.html.

resilience and maintaining public confidence in the stability of the U.S. financial system. This tech sprint was focused on how to foster stronger operational resiliency in banking, particularly for community banks, by identifying existing and proposed measures, data, tools, or other capabilities upon which a greater understanding of a bank's true resilience to any hazard may be gained. After an application process and three weeks of brainstorming and meeting with FDIC and community bank subject matter experts, six participating teams developed solutions addressing the problem.

Advancement of Agency Mission: The FDIC sought diverse and innovative solutions to devise the most helpful set of measures, data, tools, or other capabilities for financial institutions, particularly community banks, to use to determine and to test their operational resilience against a disruption; the Tech Sprint allowed for the exploration of solutions through agile processes. This activity supports the FDIC's mission of "examining and supervising financial institutions for safety and soundness and consumer protection." The knowledge gained in reviewing proposed solutions may inform future FDIC decisions

Plan for Upcoming Two Fiscal Years: The FDIC does not currently plan to conduct prize competitions in FY23 and FY24.

B.8.3. Measuring the Effectiveness of Digital Identity Proofing for Digital Financial Services[178]

Sponsoring Agency and Office: NA

Authority: Federal Deposit Insurance Act

Competition Summary: The FDIC and Financial Crimes Enforcement Network (FinCEN) conducted a tech sprint to identify a scalable, cost-efficient, risk-based solution to measure the effectiveness of digital identity proofing to ensure that individuals who remotely (i.e., not in person) present themselves for financial activities are, in fact, who they claim to be.

Advancement of Agency Mission: The FDIC and FinCEN sought diverse and innovative solutions to measure the effectiveness of digital identity proofing for greater reliance in assessment and calibration of risks. The Tech Sprint helped facilitate the exploration of solutions through agile processes. This activity supports the FDIC's mission of "examining and supervising financial institutions for safety and soundness and consumer protection." The knowledge gained in reviewing proposed solutions may inform future FDIC decisions.

Plan for Upcoming Two Fiscal Years: The FDIC does not currently plan to conduct prize competitions in FY23 and FY24.

B.9. General Services Administration (GSA)

B.9.1. Help us improve digital forms![179]

Sponsoring Agency and Office: Office of Government-wide Policy

Authority: 40 U.S.C. § 506

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[178] The website for Measuring the Effectiveness of Digital Identity Proofing for Digital Financial Services is accessible at https://www.fdic.gov/fditech/techsprints/measuring-effectiveness.html.

[179] The website for Help us improve digital forms! is accessible at https://oes.gsa.gov/projects/digital-forms/.

Competition Summary: The American public spends approximately 11.5 billion hours per year filling out federal government forms. Form complexity can result in lack of submission or completion, and errors on forms can cause processing delays and affect whether the form is accepted — which can have far-reaching consequences. OES implemented a randomized control trial (RCT) to build evidence on the magnitude and direction of the effect of instruction positioning in federal forms. OES evaluated two versions of a brief digital form which included questions typical of federal forms. One version included the form instructions on the first page, while the other version embedded the form instructions within each page of the form. To generate a sample of users, OES conducted outreach among the general public and federal employees. Between July 19 and August 19, 2022, there were 3,203 individuals randomly assigned to the two versions of the form. This evaluation—a first of its kind in the federal government—brought together multiple GSA offices and the American public to learn about the feasibility of incorporating A/B testing into federal forms and to show that form design matters for form completion. The empirical findings indicate that where instructions are placed impacts form submission, a substantive finding on the most fundamental outcome on filling out a form.

Advancement of Agency Mission: This pilot on the feasibility of incorporating A/B testing uncovered opportunities (e.g., public enthusiasm for improving federal forms) and challenges (e.g., limited control over the randomization process and access desired outcome data, such as time to completion and capturing incomplete responses). This evaluation showed federal forms are ripe for improvement and evidence-building activities that inform form design could reduce burdens on the public. While interest in improving federal forms among the federal government and public is high, more work is needed to improve the testing infrastructure of federal forms in order to build and apply rigorous evidence to improve form design.

Plan for Upcoming Two Fiscal Years: N/A

B.10. National Aeronautics and Space Administration (NASA)

B.10.1.   Advanced Lightweight Lunar Gantry for Operations (ALLGO)[180]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: Deployment and operations of a lunar base require an effective system to unload payloads from various lander configurations and transport those payloads to the Artemis base camp that, for safety reasons, will be located one or more kilometers away from the landing site. This contest was in support of a NASA concept study called the Advanced Lightweight Lunar Gantry for Operations (ALLGO). The goal of the ALLGO study is to develop an innovative, low-mass unloading system based on inflatable structural components that can be tightly packaged and easily deployed on the lunar surface. The competition was hosted by GrabCAD and received 130 submissions from 25 countries. The top five entries shared a prize purse of $10,000.

Advancement of Agency Mission: The challenge results have been used to inform and improve the quality of deliverables for the ALLGO study in support of the Artemis program.

Plan for Upcoming Two Fiscal Years: N/A

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[180] The website for Advanced Lightweight Lunar Gantry for Operations (ALLGO) is accessible at https://grabcad.com/challenges/nasa-challenge-an-advanced-lightweight-lunar-gantry-for-operations-allgo.

B.10.2. Aftershock: NASA Shock Propagation Prediction Challenge[181]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: The Aftershock: NASA Shock Propagation Prediction Challenge sought novel shock propagation prediction models that improve NASA's ability to predict shock loads through spacecraft. Freelancer.com administered the challenge and received 11 submissions from nine countries. The top four entries shared a prize purse of $50,000.

Advancement of Agency Mission: The challenge sought solutions in the form of shock prediction using the ShockSat dataset and white papers to help NASA improve predictions of how shock loads travel through a spacecraft. Contestants were asked to use a collection of acceleration measurements from around the ShockSat test structure to predict the shock experienced at other points on the testbed. Their white papers described the methodology applied to predict the shock, speed and hardware considerations, and the versatility/extensibility of the solution. The entries will be used to inform the development of ShockSat.

Plan for Upcoming Two Fiscal Years: N/A

B.10.3. Big Idea Challenge 2021 - Lunar Dust Mitigation[182]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Cooperative Agreement #80LARC17C0004

Competition Summary: The Breakthrough, Innovative, and Game-changing (BIG) Idea Challenge is an initiative supporting NASA's Space Technology Mission Directorate's (STMD's) Game Changing Development Program (GCD) efforts to rapidly mature innovative/high impact capabilities and technologies for infusion in a broad array of future NASA missions. The BIG Idea Challenge also offers real world experience for university students in the development of the systems needed to support NASA's exploration goals. The BIG Idea challenge allows students to incorporate their coursework into real aerospace design concepts and work together in a team environment. Multi-university and interdisciplinary teams are encouraged. The 2021 BIG Idea Challenge sought innovative ideas from teams of undergraduate and graduate students at accredited U.S.-based colleges and universities affiliated with their state's Space Grant Consortium (or partnered with a space grant affiliated university) for near term, innovative and viable solutions for dealing with the Moon's abrasive dust. Teams of 5-25 students from Space Grant affiliated colleges and universities were invited to submit robust proposals on novel concepts for near-term active and/or passive dust mitigation (or dust tolerant) technologies that could be used for lunar applications near or in the Moon's South Pole. Selected teams received awards ranging between $50,000 and $180,000 to bring their ideas to life. In FY21, Space Grant leveraged funds to help develop the next line of a STEM-trained workforce with skills and experience aligned directly with STMD technology focus areas and capability needs. For this reason, participation in the 2021 BIG Idea Challenge was limited to space-grant affiliated universities.

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[181] The website for Aftershock: NASA Shock Propagation Prediction Challenge is accessible at https://www.freelancer.com/contest/Aftershock-NASA-Shock-Propagation-Prediction-Challenge-2047359.

[182] The website for Big Idea Challenge 2021 - Lunar Dust Mitigation is accessible at https://bigidea.nianet.org/past-competition-themes/2021-forum-results/.

Advancement of Agency Mission: The Challenge is an initiative that engages the university community with NASA's Game Changing Development (GCD) Program efforts to rapidly mature innovative/high impact capabilities and technologies for infusion in a broad array of future NASA missions. It links academic institutions with the NASA Space Technology Mission Directorate (STMD), and multidisciplinary university teams are asked to provide innovative solutions to current projects GCD is working on. Each year, the program theme is developed by one of GCD's Principle Technologists (PT), which allows the academic community to be an active, productive, and contributing part of the PT's work at NASA. Within this framework, NASA communicates and interacts with the innovative minds of tomorrow, sharing concepts and technology that could lead to opportunities for future NASA missions. The competition is intended to be an open innovation challenge with minimal constraints so that proposing teams can genuinely create and develop out-of-the-box solutions.

Plan for Upcoming Two Fiscal Years: The FY23 BIG Idea Challenge has been launched and is currently ongoing, to be completed in Q1FY24. It is presumed that the FY24 BIG Idea Challenge will be launched in FY23 Q3, ongoing through FY24, and completed in FY25Q1.

B.10.4. Big Idea Challenge 2022 - Extreme Terrain Mobility[183]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Cooperative Agreement #80LARC17C0004

Competition Summary: The Breakthrough, Innovative, and Game-changing (BIG) Idea Challenge is an initiative supporting NASA's Space Technology Mission Directorate's (STMD's) Game Changing Development Program (GCD) efforts to rapidly mature innovative/high impact capabilities and technologies for infusion in a broad array of future NASA missions. The BIG Idea Challenge also offers real world experience for university students in the development of the systems needed to support NASA's exploration goals. The BIG Idea challenge allows students to incorporate their coursework into real aerospace design concepts and work together in a team environment. Multi-university and interdisciplinary teams are encouraged. The 2022 BIG Idea Challenge asked teams of undergraduate and graduate students at accredited U.S.-based colleges and universities affiliated with their state's Space Grant Consortium (or partnered with a space grant affiliated university) to design, develop, and demonstrate robotic systems with alternative rover locomotion modalities for use in off-world extreme lunar terrain applications. Teams of 5-25 students were invited to submit robust proposals for robots with new mobility solutions in operating scenarios that require access to extreme terrain categories. Selected teams received awards ranging between $50,000 and $180,000 to bring their ideas to life. In FY22, Space Grant leveraged funds to help develop the next line of a STEM-trained workforce with skills and experience aligned directly with STMD technology focus areas and capability needs. For this reason, participation in the 2022 BIG Idea Challenge was limited to space-grant affiliated universities.

Advancement of Agency Mission: The Challenge is an initiative that engages the university community with NASA's Game Changing Development (GCD) Program efforts to rapidly mature innovative/high impact capabilities and technologies for infusion in a broad array of future NASA missions. It links academic institutions with the NASA Space Technology MissionDirectorate (STMD), and multidisciplinary university teams are asked to provide innovative solutions to current projects GCD is working on. Each year, the program theme is developed by one of GCD's Principle Technologists (PT),

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[183] The website for Big Idea Challenge 2022 - Extreme Terrain Mobility is accessible at https://bigidea.nianet.org/competition-basics/2022-forum-results/.

which allows the academic community to be an active, productive, and contributing part of the PT's work at NASA. Within this framework, NASA communicates and interacts with the innovative minds of tomorrow, sharing concepts and technology that could lead to opportunities for future NASA missions. The competition is intended to be an open innovation challenge with minimal constraints so that proposing teams can genuinely create and develop out-of-the-box solutions.

Plan for Upcoming Two Fiscal Years: The FY23 BIG Idea Challenge has been launched and is currently ongoing, to be completed in Q1FY24. It is presumed that the FY24 BIG Idea Challenge will be launched in FY23 Q3, ongoing through FY24, and completed in FY25Q1.

B.10.5. Break the Ice Lunar[184]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: NASA Space Act

Competition Summary: As NASA works to extend human exploration of the solar system, a sustained presence on the Moon will be critical for developing and testing the technologies and systems needed for future missions to Mars and beyond. In situ resource utilization (ISRU)—the development of lunar materials for life support, fuel, energy, manufacturing, and construction—is necessary to limit the delivery of supplies from Earth. One of the most important of these resources is water. Water supports all life on Earth and will be critical to supporting human exploration beyond Earth. On the Moon, water is trapped in icy regolith at the lunar poles, including inside permanently dark and shadowed regions. The Break the Ice Lunar Challenge seeks to incentivize innovative approaches for excavating icy regolith and delivering acquired resources in extreme lunar environmental conditions. The Challenge seeks to incentivize solutions for maximizing resource delivery while minimizing energy use and the mass of equipment delivered to the lunar surface. Phase 1 challenged teams to design a system architecture for collecting and moving large amounts of icy regolith and water from a permanently shadowed region near the Moon's South Pole. Teams had seven months to register and submit a detailed system architecture, an excavation plan, and an animation of the system in operation. Thirty-one teams – including academia, industry, and independent inventors from 17 U.S. states, Canada, Australia, and Sri Lanka – submitted eligible proposals. The goal of Phase 2 is to further the development of technologies that can excavate and transport large quantities of icy lunar regolith and can address the challenging associated with operating in the lunar environmental conditions.

Advancement of Agency Mission: NASA's mission of long-term presence on the Moon and beyond is possible only through In-Situ Resource Utilization. Results from this challenge will help NASA identify and further develop technologies to excavate icy regolith from which water can be extracted.

Plan for Upcoming Two Fiscal Years: Break the Ice Phase 2 will be continuing in FY23 and FY24.

B.10.6. Cinespace 2020[185]

Sponsoring Agency and Office: Human Exploration and Operations Mission Directorate

Authority: Procurement

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[184] The website for Break the Ice is accessible at https://www.nasa.gov/prizes-challenges-and-crowdsourcing/centennial-challenges/break-the-ice-challenge/.
[185] The website for Cinespace 2020 is accessible at https://tongal.com/CineSpace2020#tab-brief.

Competition Summary: NASA and the Houston Cinema Arts Society hosted the annual CineSpace Short Film Competition, inviting filmmakers, editors, and animators from around the world to explore NASA's digital archives and create short films inspired by, and incorporating, real NASA footage. Tongal administered the challenge and received 299 entries from 53 countries. The top five winners shared a prize purse of $30,000.

Advancement of Agency Mission: The competition is intended as an outreach and engagement mechanism to reach creative audiences. It spurs creativity and educates the public.

Plan for Upcoming Two Fiscal Years: NASA intends to hold future CineSpace competitions as funding allows.

B.10.7. Cube Quest[186]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: NASA Space Act

Competition Summary: The Cube Quest competition offers a total prize purse of $5 million to teams that meet the challenge objectives of designing, building and delivering flight-qualified, small satellites capable of advanced operations near and beyond the moon. The competition includes three stages: Ground Tournaments, Deep Space Derby, and Lunar Derby. All teams may compete in any one of the four Ground Tournaments. Teams that rate high on mission safety and probability of success will receive incremental awards. The Ground Tournaments will be held every four to six months, leading to an opportunity to earn a spot on the first integrated flight of Orion and SLS. The Deep Space Derby will focus on finding innovative solutions to deep space communications using small spacecraft, and the Lunar Derby will focus primarily on propulsion for small spacecraft and near-Earth communications. Together, these challenges are expected to contribute to opening deep space exploration to non-government spacecraft for the first time. Advancements in small spacecraft capabilities may not only provide benefits to future missions, but also may enable entirely new mission scenarios. The Cube Quest Challenge seeks to establish precedence for all subsystems necessary to perform deep-space exploration using small spacecraft.

Advancement of Agency Mission: CubeSats are low cost high return payloads. Most of the CubeSats operate in the low earth orbit. Pushing the CubeSat technologies so that they can operate in Deep Space will open plethora of new opportunities for science missions.

Plan for Upcoming Two Fiscal Years: Cube Quest Challenge will be continuing in FY23 and FY24.

B.10.8. Deep Space Food Challenge[187]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: NASA Space Act

Competition Summary: In coordination with the Canadian Space Agency, NASA opened the Deep Space Food Challenge. The goal is to generate novel food production technologies or systems that require

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[186]   The   website   for   Cubequest   is   accessible   at https://www.nasa.gov/directorates/spacetech/centennial_challenges/cubequest/index.html.

[187] The website for Deep Space Food Challenge is accessible at https://www.nasa.gov/prizes-challenges-and-crowdsourcing/centennial-challenges/deep-space-food-challenge/.

minimal resources and produce minimal waste, while providing safe, nutritious, and tasty food for long-duration human exploration missions. NASA, in partnership with the Methuselah Foundation, is overseeing United States and international competitors. Advanced food systems will have benefits on Earth too. Solutions from this challenge could enable new avenues for food production around the world, especially in extreme environments, resource-scarce regions, and in new places like urban areas and in locations where disasters disrupt critical infrastructure.

Advancement of Agency Mission: Solutions from the Deep Space Food Challenge could be part of the larger food system as an integrated solution that: provides all daily nutritional needs; provides a variety of palatable and safe food choices; enables acceptable, safe, and quick preparation methods; and limits resource requirements with no dependency on direct periodic resupply from Earth over durations increasing from months to years.

Plan for Upcoming Two Fiscal Years: Phase 3 of the Deep Space Food Challenge will begin in FY23 and continue through FY24.

B.10.9. Future-Scaping our Skies Challenge[188]

Sponsoring Agency and Office: Aeronautics Research Mission Directorate

Authority: Procurement

Competition Summary: The "Future-Scaping Our Skies" Challenge aimed to understand how societal, technological, environmental, economic, regulatory, and political changes over the next 30 years could impact aviation and vice versa, as well as identify and tackle wicked problems currently faced by aviation. A 2021 competition was administered by Tech7 and received 43 entries from the United States. The top nine winners shared a prize purse of $21,000. The challenge team continues to assess the current and future climate of aviation through the hiring of freelancers.

Advancement of Agency Mission: NASA's Convergent Aeronautics Solutions project invests in seemingly improbably ideas that might lead to solutions to the problems that plague aviation and impact safety, environmental and community impact, and the global growth in air traffic. The "Future-Scaping Our Skies" Challenge aimed to understand how societal, technological, environmental, economic, regulatory, and political changes over the next 30 years could impact aviation and vice versa.

Plan for Upcoming Two Fiscal Years: N/A

B.10.10. Honey, I Shrunk the NASA Payload[189]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: In the previous Honey, I Shrunk the NASA Payload Challenge, 14 teams were recognized and awarded for their insightful and creative approaches to developing miniature payloads that will help collect information about the lunar environment and potential lunar resources. This challenge offered those winning teams the opportunity to vie for development funds and prizes. This phase also included opportunities for NASA to review team plans and/or progress and to provide

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[188] The website for Future-Scaping our Skies Challenge is accessible at https://www.herox.com/FutureScaping.
[189] The website for Honey, I Shrunk the NASA Payload is accessible at https://www.herox.com/NASAPayload2.

specific, individual feedback. The 14 teams were narrowed to four, ultimately awarding the top three teams and solutions.

Advancement of Agency Mission: The final payloads have undergone numerous flight readiness tests to determine their flight capability. They now await possible assignment to a future flight to the Moon.

Plan for Upcoming Two Fiscal Years: N/A

B.10.11. Human Explorer Rover Challenge[190]

Sponsoring Agency and Office: Human Exploration and Operations Mission Directorate

Authority: 51 USC 2011(e)

Competition Summary: The Human Exploration Rover Challenge (HERC) is a research-based, competitive, experiential engineering challenge that mimics NASA's fundamental project life cycle, which gives participants a feel of the Human Exploration and Operation Mission Directorate (HEOMD) workforce. It provides students with realistic, cost-effective research and project development opportunities akin to NASA's missions. HERC is a 7-month commitment in which participating students research, design, and build a working, human-powered vehicle, and task tools to complete mission tasks. Throughout the design and build period, teams must submit a series of reports and reviews, provide a project timeline and budget, establish a social media presence, and engage other students in STEM education. Teams first register (international teams are required to submit a proposal that outlines their anticipated work) then go through several design phases to ensure that they are meeting vehicle, task tool, and safety requirements. In the first phase's report, the Design Review (DR), students are to demonstrate that their rover's construction/maturity is on track to be excursion-ready, scheduling and budget constraints are being met, and critical analyses and testing have been completed. The second phase's report, the Operational Readiness Review (ORR), sees students demonstrate that all personnel, processes/procedures, vehicles, and components are ready to safely execute the mission. Teams defend their projects with presentations via video conference to a NASA review panel at each of these project milestones.

Advancement of Agency Mission: HERC serves to expose students to real-world engineering challenges in order to improve STEM literacy with the goal of building the future STEM workforce.

Plan for Upcoming Two Fiscal Years: HERC will continue in FY23 following the same basic format and is expected to continue in FY24 as well.

B.10.12. Human-Autonomy Teaming Task Battery (HATTB) App[191]

Sponsoring Agency and Office: Aeronautics Research Mission Directorate

Authority: Procurement

Competition Summary: NASA is developing a new software application called the Human-Autonomy Teaming Task Battery, or HATTB. The HATTB is a research software application used to conduct experiments that evaluate the performance of research participants as they monitor simulated autonomous objects (e.g., vehicles) and simultaneously perform various other predefined tasks. The

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[190] The website for Human Explorer Rover Challenge is accessible at https://nasa.gov/herc.
[191] There was no website provided for Human-Autonomy Teaming Task Battery (HATTB) App.

competition was administered by Topcoder and received 104 entries from 13 countries. Thirty-three participants were awarded a share of $172,360.

Advancement of Agency Mission: The successful submissions were used to inform the developers of the HATTB and improve the software code.

Plan for Upcoming Two Fiscal Years: N/A

B.10.13.   Lunabotics[192]

Sponsoring Agency and Office: Human Exploration and Operations Mission Directorate

Authority: Procurement

Competition Summary: The Lunabotics competition provides college students from around the country an opportunity to engage with the NASA Systems Engineering process by designing and building robotic Lunar excavators capable of mining regolith and icy regolith simulants. Major gaps exist between the functional capabilities and the technologies necessary for Lunar surface construction and the requirements needed to support the long-term presence on the Moon, also known as "Infrastructure to Stay". Lunabotics will aid in developing innovative ways to apply existing or develop new technologies to meet Artemis Program requirements. Students are challenged to design and build a robot to navigate and excavate simulated icy regolith buried then return to the starting site and deliver the granular material to a simulated receiving hopper. This is a two-semester, virtual challenge, designed to educate college students in the application of the NASA Systems Engineering process. During this challenge student are required to provide the following for review by a NASA panel of engineers: Project Management Plan; Systems Engineering Paper; Public Outreach Report; Presentation and Demonstration; and an optional Proof of Robot Life Video. Lunabotics is a collaboration with the NASA Explorations Systems Development Mission Directorate, the Office of STEM, Engagement, and the Artemis Student Challenges.

Advancement of Agency Mission: Lunabotics encourages universities/colleges/vocational-tech schools to throw their academic might at solving real world engineering problems that exist in our Nation's quest to return to the Moon. We are also inspiring and educating The Next Generation STEM workforce who will take the Artemis torch and move it forward.

Plan for Upcoming Two Fiscal Years: For FY 23 and FY 24 the plan is to continue holding the competition.

B.10.14.   Lunabotics Jr Challenge[193]

Sponsoring Agency and Office: Human Exploration and Operations Mission Directorate

Authority: Procurement

Competition Summary: NASA called on U.S. K-12 students for their unique design concepts for lunar excavators that can operate in lunar gravity. In order to have a sustainable presence on the Moon, it will be necessary to excavate lunar regolith to extract local resources. NASA is already working on prototypes for its upcoming missions. This challenge was designed to attract student ideas and solutions to the problem of extracting lunar resources. The challenge was administered by Future

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[192] The website for Lunabotics is accessible at https://www.spaceappschallenge.org/.
[193] The website for Lunabotics Jr Challenge is accessible at https://www.spaceappschallenge.org/.

Engineers and received 2,280 entries. Twenty submissions were recognized as semifinalists, finalists, and grand prize winners.

Advancement of Agency Mission: The challenge was used as an outreach channel to inform U.S. K-12 students of its Artemis mission.

Plan for Upcoming Two Fiscal Years: N/A

### B.10.15.	Lunar Deep Freeze Challenge[194]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: NASA has a mission critical need for novel small-footprint, lightweight, and low-/no-power cryogenic (less than -150°C) containment solutions that will enable long-term storage and transportation of lunar material samples back to Earth. The objective of this Challenge was to conceptualize and describe a novel approach to cryogenic containment that will allow lunar sample transport from the Moon to Earth. The challenge was administered by TechConnect and received 76 entries from 20 countries. One winner was awarded.

Advancement of Agency Mission: The submissions will be used to inform the Artemis team as they develop containment solutions for lunar material samples.

Plan for Upcoming Two Fiscal Years: N/A

### B.10.16.	Lunar Loo Challenge[195]

Sponsoring Agency and Office: Human Exploration and Operations Mission Directorate

Authority: Procurement

Competition Summary: NASA called on the global community for their novel design concepts for compact toilets that can operate in both microgravity and lunar gravity. These designs may be adapted for use in the Artemis lunar landers that take us back to the Moon. A related Junior challenge was also run to engage students and younger audiences. The challenge was administered by HeroX and received 2,953 entries from 107 countries. Three entries were awarded in the technical challenge, while ten entries were recognized in the Junior challenge.

Advancement of Agency Mission: The toilet designs are being used to inform development of toilets for the Artemis missions.

Plan for Upcoming Two Fiscal Years: N/A

### B.10.17.	Lunar TORCH[196]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

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[194] The website for Lunar Deep Freeze Challenge is accessible at https://l1.techconnectventures.com/.
[195] The website for Lunar Loo Challenge is accessible at https://www.herox.com/LunarLoo.
[196] The website for Lunar TORCH is accessible at https://grabcad.com/challenges/nasa-challenge-lunar-torch.

Competition Summary: NASA sought designs for a mobile lunar heliostat that can be used to support operations at the Artemis Base Camp by redirecting solar energy where it is most needed. The challenge was administered by GrabCAD and received 190 entries from 30 countries. Five winners were awarded.

Advancement of Agency Mission: The challenge results will inform NASA as it develops the Lunar TORCH system for future Artemis missions.

Plan for Upcoming Two Fiscal Years: N/A

B.10.18. Micro-g NExT[197]

Sponsoring Agency and Office: Human Exploration and Operations Mission Directorate

Authority: 51 U.S. Code § 20113(e)

Competition Summary: Micro-gravity Neutral Buoyancy Experiment Design Teams (Micro-g NExT) Challenge is an annual opportunity for undergraduate students to contribute to NASA's mission. Micro-g NExT challenges undergraduate students to design, build, and test a tool or device that addresses an authentic, current space exploration challenge. The overall experience includes hands-on engineering design, test operations, and public outreach. Test operations are conducted in the simulated microgravity environment of the NASA Johnson Space Center Neutral Buoyancy Laboratory (NBL). Teams will propose design and prototyping of a tool or device identified by NASA engineers as necessary in space exploration missions. Professional NBL divers test the tools and students direct the divers from the Test Conductor Room of the NBL facility.

Advancement of Agency Mission: Undergraduate student teams are integrated directly into the NASA technology and hardware development path and create and test hardware directly benefiting NASA missions. Benefits are realized in the area of accelerated technology and hardware development directly applicable to space exploration. Micro-g NExT student designed tools have been integrated into astronaut training in the Neutral Buoyancy Laboratory (NBL), analog mission training with NASA Extreme Environment Mission Operation (NEEMO), and the Alpha Magnetic Spectrometer (AMS) repair spacewalks aboard the International Space Station. The integration of these tools into NASA missions demonstrate the value of student contributions to NASA's mission.

Plan for Upcoming Two Fiscal Years: Micro-g NExT is annual challenge opportunity. FY23 activities have launch and are ongoing.

B.10.19. Moon Pod Essay Contest[198]

Sponsoring Agency and Office: Office of STEM Engagement

Authority: Procurement

Competition Summary: NASA challenged U.S. K-12 students to imagine they will lead a crew of astronauts on a one-week expedition to the Moon's South Pole, and then write about it. The challenge was administered by Future Engineers and received 13,898 entries. Three winners were awarded.

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[197] The website for Micro-g NExT is accessible at https://microgravityuniversity.jsc.nasa.gov/about-micro-g-next.
[198] The website for Moon Pod Essay Contest is accessible at https://www.futureengineers.org/artemismoonpodessay.

Advancement of Agency Mission: The challenge intended to engage and educate students about NASA's Artemis mission.

Plan for Upcoming Two Fiscal Years: N/A

B.10.20.   NASA Air-athon: Predict Air Quality[199]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: The goal of this challenge was to generate daily estimates of surface-level NO_2 and PM2.5 across 5-kilometer grid spacing across three urban areas: Los Angeles South Coast Air Basin, United States; Delhi, India; and Taipei, Taiwan. The challenge was administered by DrivenData and received 1,263 entries from 43 countries. Six winners were awarded.

Advancement of Agency Mission: This competition advanced the science of estimating surface-level air pollutant concentrations to address air pollution, one of the greatest environmental threats to human health. The results will contribute to the development of more accurate air quality data products from recently launched and future NASA satellite missions, including TEMPO (Tropospheric Emissions: Monitoring of Pollution), MAIA (Multi-Angle Imager for Aerosols), and AOS (Atmosphere Observing System).

Plan for Upcoming Two Fiscal Years: N/A

B.10.21.   NASA Cognitive State Determination System[200]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: NASA sought a system that provides real-time operations support that is optimized and tailored to each astronaut's psychophysiological state at the time of the activities and which can be used during training leading up to the mission. The challenge was administered by Topcoder and received 469 entries from 15 countries. Thirty winners were awarded.

Advancement of Agency Mission: The models will help develop NASA's human spaceflight efforts.

Plan for Upcoming Two Fiscal Years: N/A

B.10.22.   NASA Earth Science in Action Comic Strip Contest[201]

Sponsoring Agency and Office: Science Mission Directorate

Authority: Procurement

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[199]   The website for NASA Air-athon: Predict Air Quality is accessible at https://www.drivendata.org/competitions/88/competition-air-quality-pm/.
[200]   The website for NASA Cognitive State Determination System is accessible at https://www.topcoder.com/community/nasa/cognitive-state.
[201]   The website for NASA Earth Science in Action Comic Strip Contest is accessible at https://www.sciartex.net/science-in-action-nasa-earth-comic-strip-contest.html.

Competition Summary: The public was invited to create action-packed comics that tell the stories of how satellite imagery benefits life on Earth. The challenge was administered by SciArt Exchange and received 96 submissions from 14 countries. Ten winners were awarded.

Advancement of Agency Mission: The NASA Earth Science in Action Comic Strip Challenge increased public engagement with recent NASA Earth science application stories and allowed artists from around the world to see the impact of NASA's Earth observations. The winning comics are being shared globally as accessible tools to inspire and educate others about the applications of NASA's satellite imagery for societal benefit.

Plan for Upcoming Two Fiscal Years: N/A

B.10.23. NASA Image Co-registration Code Challenge[202]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: NASA sought development of a software application called the Lunar Mission Coregistration Tool (LMCT) that will process publicly available image files from past lunar missions and will enable manual comparison to imagery from the Lunar Reconnaissance Orbiter (LRO) mission. The challenge was administered by Topcoder and received 12 submissions from nine countries. Ten winners were awarded.

Advancement of Agency Mission: The imagery processed by this software will be used in existing citizen science applications to identify long lost spacecraft components as well as natural impacts to the lunar surface.

Plan for Upcoming Two Fiscal Years: N/A

B.10.24. NASA MarsXR Challenge[203]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: This challenge asked developers to create a new Virtual Reality (XR) research, development, and testing environment to help prepare for the experiences and situations that will be encountered on Mars. Participants will use the NASA XR Operations Support System (XOSS) MarsXR Virtual Environment to build out new assets and scenarios within the environment, using Epic Games' UnReal Engine. The challenge was administered by HeroX and received 34 submissions from 21 countries. Nine winners were awarded.

Advancement of Agency Mission: The resulting assets and scenarios will be embedded in XOSS.

Plan for Upcoming Two Fiscal Years: A second iteration of this challenge is scheduled to take place during FY23.

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[202] The website for NASA Image Co-registration Code Challenge is accessible at https://www.topcoder.com/challenges/76c6fb0e-0de3-4d60-b472-37e238e14fc4.

[203] The website for NASA MarsXR Challenge is accessible at https://www.herox.com/MarsXR.

B.10.25.   NASA Orbital Alchemy Challenge[204]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: Through this challenge, NASA explored whether a new industry could transform this orbital debris into an orbital opportunity by creating feedstocks from recycled spacecraft. The challenge was administered by TechConnect and received 31 submissions from 11 countries. Five winners were awarded.

Advancement of Agency Mission: The proposals will be used to inform NASA's future efforts in repurposing space waste.

Plan for Upcoming Two Fiscal Years: N/A

B.10.26.   NASA RASC-AL Competition 2021[205]

Sponsoring Agency and Office: Human Exploration and Operations Mission Directorate

Authority: Cooperative Agreement #80LARC17C0004

Competition Summary: Revolutionary Aerospace Systems Concept Academic Linkage (RASC-AL) competitions fuel innovation for aerospace systems concepts, analogs, and technology prototyping by bridging gaps through university engagement. RASC-AL is open to undergraduate and graduate university-level students studying fields with applications to human space exploration (i.e., aerospace, bio-medical, electrical, and mechanical engineering; and life, physical, and computer sciences). RASC-AL projects allow students to incorporate their coursework into real aerospace design concepts and work together in a team environment. Interdisciplinary teams are encouraged. Through RASC-AL, teams and their faculty advisors will design innovative solutions with supporting original engineering and analysis in response to one of the following five themes: Durable Low-Mass Lunar Surface Habitat; Minimum Mars Ascent Vehicle; Venus Flyby Mission; Human Mission to Ceres; and Distributed Lunar Sample Aggregation, Analysis, and Return to the International Space Station (ISS). In FY21, 14 teams were chosen to compete in the Virtual RASC-AL Forum. Each team received a monetary award to facilitate full participation in the RASC-AL Forum. The teams with the top two winning papers were invited to present their design projects to industry experts at American Institute of Aeronautics and Astronautics' (AIAA) ASCEND conference (Accelerating Space Commerce, Exploration, and New Discovery).

Advancement of Agency Mission: RASC-AL teams provide solutions to real-world NASA challenges, through fresh, innovative concepts and technologies that will help to expand human presence into the solar system from the top-minds at America's best engineering schools. Students are required to demonstrate original engineering and analysis in response to these Challenges. NASA engineers can leverage the interaction with faculty and students on design problems relevant to NASA, and explore workforce pipeline opportunities to attract a highly skilled, competent, and diverse workforce. RASC-AL contributes to the Agency's goals to enhance STEM experience of undergraduate students and provide graduate-trained STEM professionals with basic and applied research expertise.

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[204]   The   website   for   NASA   Orbital   Alchemy   Challenge   is   accessible   at https://nasaorbitalalchemy.techconnectventures.com/.

[205] The website for NASA RASC-AL Competition 2021 is accessible at https://rascal.nianet.org.

Plan for Upcoming Two Fiscal Years: The FY23 RASC-AL Competition has been launched and is currently ongoing, to be completed in FY23. It is presumed that the FY24 RASC-AL Competition will be launched in FY23 Q4, ongoing through FY24, and completed in FY24 Q3.

B.10.27. NASA RASC-AL Competition 2022[206]

Sponsoring Agency and Office: Exploration Systems Development Mission Directorate

Authority: Cooperative Agreement #80LARC17C0004

Competition Summary: Revolutionary Aerospace Systems Concept Academic Linkage (RASC-AL) competitions fuel innovation for aerospace systems concepts, analogs, and technology prototyping by bridging gaps through university engagement. RASC-AL is open to undergraduate and graduate university-level students studying fields with applications to human space exploration (i.e., aerospace, bio-medical, electrical, and mechanical engineering; and life, physical, and computer sciences). RASC-AL projects allow students to incorporate their coursework into real aerospace design concepts and work together in a team environment. Interdisciplinary teams are encouraged. Through RASC-AL, teams and their faculty advisors will design innovative solutions with supporting original engineering and analysis in response to one of the following four themes: 1) Suitport Logistics Carrier 2) Portable Utility Pallet 3) Mars Water-based ISRU Architecture 4) Universal Sample Containment System In FY22, 15 teams were chosen to compete in the RASC-AL Forum. Each team received a monetary award to facilitate full participation in the RASC-AL Forum. The teams with the top two winning papers were invited to present their design projects to industry experts at the American Institute of Aeronautics and Astronautics' (AIAA) ASCEND conference (Accelerating Space Commerce, Exploration, and New Discovery).

Advancement of Agency Mission: • RASC-AL teams provide solutions to real-world NASA challenges, through fresh, innovative concepts and technologies that will help to expand human presence into the solar system from the top-minds at America's best engineering schools. Students are required to demonstrate original engineering and analysis in response to these Challenges. (Strategic Objective 1.3; Strategic Objective 2.1; Strategic Objective 2.3). • NASA engineers can leverage the interaction with faculty and students on design problems relevant to NASA, and explore workforce pipeline opportunities to attract a highly skilled, competent, and diverse workforce. (Strategic Objective 3.1; Strategic Objective 4.1). • RASC-AL contributes to the Agency's goals to enhance STEM experience of undergraduate students and provide graduate-trained STEM professionals with basic and applied research expertise. (Strategic Objective 4.3)

Plan for Upcoming Two Fiscal Years: The FY23 RASC-AL Competition has been launched and is currently ongoing, to be completed in FY23. It is presumed that the FY24 RASC-AL Competition will be launched in FY23 Q4, ongoing through FY24, and completed in FY24 Q3.

B.10.28. NASA SOHO Comet Search Challenge[207]

Sponsoring Agency and Office: Science Mission Directorate

Authority: Procurement

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[206] The website for NASA RASC-AL Competition 2022 is accessible at https://rascal.nianet.org.
[207] The website for NASA SOHO Comet Search Challenge is accessible at https://www.topcoder.com/community/nasa/soho-comet-search.

Competition Summary: NASA sought to use artificial intelligence/machine learning to identify comets in Solar and Heliospheric Observatory (SOHO) and Large Angle and Spectrometric Coronagraph Experiment (LASCO) satellite data. The challenge was administered by Topcoder and received 527 entries from 81 countries. Ten winners were awarded.

Advancement of Agency Mission: The resulting algorithms identified two previously unknown comets. The code will continue to be used by NASA to analyze SOHO/LASCO data.

Plan for Upcoming Two Fiscal Years: N/A

B.10.29. NASA Spacesuit Detection Challenge[208]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: NASA sought novel solutions to label and identify spacesuit motions from conventional and readily available video and photographs to overcome current system limitations in terms of cost and training feasibility. The challenge was administered by Topcoder and received 285 entries from 12 countries. Five winners were awarded.

Advancement of Agency Mission: The resulting algorithms will be implemented into NASA's spacesuit research and testing.

Plan for Upcoming Two Fiscal Years: N/A

B.10.30. NASA Waste Jettison Mechanism Challenge[209]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: NASA sought concepts for a jettison mechanism to eject non-recyclable material from a crewed spacecraft during transit to and from Mars. The challenge was administered by HeroX and received 42 submissions from 17 countries. Five winners were awarded.

Advancement of Agency Mission: The challenge results will inform NASA's plans for future human spaceflight.

Plan for Upcoming Two Fiscal Years: N/A

B.10.31. NASA's Lunar Delivery Challenge[210]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

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[208]   The website for NASA Spacesuit Detection Challenge is accessible at https://www.topcoder.com/challenges/116fc3d9-a4e0-4a93-8ef1-a075ae16ee88.
[209]   The website for NASA Waste Jettison Mechanism Challenge is accessible at https://www.herox.com/JettisonChallenge.
[210] The website for NASA's Lunar Delivery Challenge is accessible at https://www.herox.com/LunarDelivery.

Competition Summary: NASA sought concepts to address how to unload payloads from lunar landers during future Artemis missions. The challenge was administered by HeroX and received 223 submissions from 46 countries. Six winners were awarded.

Advancement of Agency Mission: The challenge results will help inform NASA's plans for future human spaceflight and the Artemis missions.

Plan for Upcoming Two Fiscal Years: N/A

B.10.32.   New Transonic Wind Tunnel Test Section[211]

Sponsoring Agency and Office: Aeronautics Research Mission Directorate

Authority: Procurement

Competition Summary: NASA sought new ideas for innovative wind tunnel test sections that can be incorporated into the designs of next generation wind tunnel facilities and increase effectiveness. The challenge was administered by GrabCAD and received 94 submissions. Five winners were awarded.

Advancement of Agency Mission: The challenge results could inform NASA's future development of transonic wind tunnels. The ability of the test team to rapidly swap out models is a lot like the capabilities of a race car pit crew to the overall efficiency of a wind tunnel.

Plan for Upcoming Two Fiscal Years: N/A

B.10.33.   Power to Explore Student Challenge[212]

Sponsoring Agency and Office: Science Mission Directorate

Authority: Procurement

Competition Summary: K-12 students in the U.S. were challenged to research Radioisotope Power Systems (RPS), which is a type of nuclear battery, and then write about one or more uses of this special power system in space that inspires them, and what they thought their unique power was and how it would help them achieve one or more long-term goals. The challenge was administered by Future Engineers and received 879 entries. Forty-five winners were awarded.

Advancement of Agency Mission: The challenge resulted in nearly 900 essays from engaged and educated students.

Plan for Upcoming Two Fiscal Years: Future iterations of the challenge may be held as funding permits.

B.10.34.   Risky Space Business: NASA AI Risk Prediction Challenge[213]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

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[211] The website for New Transonic Wind Tunnel Test Section is accessible at https://grabcad.com/challenges/nasa-challenge-new-transonic-wind-tunnel-test-section.

[212] The website for Power to Explore Student Challenge is accessible at https://www.futureengineers.org/powertoexplore.

[213] The website for Risky Space Business: NASA AI Risk Prediction Challenge is accessible at https://www.freelancer.com/contest/Risky-Space-Business-NASA-AI-Risk-Prediction-Challenge-2008562.

Competition Summary: Participants were tasked with designing project management tools that extract past project risk information and use AI/ML to predict risks on future projects. The challenge was administered by Freelancer and received 27 entries from seven countries. Six winners were awarded.

Advancement of Agency Mission: The challenge results will inform NASA's future project planning to mitigate risk.

Plan for Upcoming Two Fiscal Years: N/A

B.10.35. Runway Functions: Predict Reconfigurations at U.S. Airports[214]

Sponsoring Agency and Office: Aeronautics Research Mission Directorate

Authority: Procurement

Competition Summary: The goal of the competition was to develop algorithmic approaches for most accurately predicting changes in the way runways are configured at US airports. These changes happen multiple times per day and have significant impact on flight delays and decisions across the National Airspace System (NAS) network. Better algorithms for predicting future airport configurations can support critical decisions, reduce costs and fuel use, and mitigate delays across the national airspace network. The challenge was administered by DrivenData and received 369 submissions from 28 countries. Four entries were awarded.

Advancement of Agency Mission: The results of this challenge will be used to improve predictions about runway configuration changes by the NAS.

Plan for Upcoming Two Fiscal Years: N/A

B.10.36. SUITS[215]

Sponsoring Agency and Office: Human Exploration and Operations Mission Directorate

Authority: 51 USC § 20113(e)

Competition Summary: NASA Spacesuit User Interface Technologies for Students (SUITS) is a mission-driven project that challenges U.S. undergraduate and graduate students to design and create spacesuit information displays within augmented reality (AR) environments. For exploration, it is essential that crewmembers on spacewalks are equipped with the appropriate enabling technologies for human-autonomy necessary for the elevated demands of lunar surface exploration and extreme terrestrial access. Teams seeking to participate must submit a proposal. Participating teams design software code in Unity providing an audiovisual, possibly tactile, augmented reality environment interface for future spacesuit informatics concept development. Teams must submit the following deliverables as part of participation: team roster; team introduction video; media release; software design review; travel poll; graphical user interface software code; poster; final report (including technical and outreach components); and peer-reviewed report publications or conference proceedings. Student contributions inform the work of NASA's Human Interface Branch. Specifically, the optimization of astronaut efficiencies while performing an extravehicular activity (EVA) contributes to the shift in autonomy and operational control scheme for extra-terrestrial surface exploration

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[214] The website for Runway Functions: Predict Reconfigurations at U.S. Airports is accessible at https://www.drivendata.org/competitions/89/competition-nasa-airport-configuration/.

[215] The website for SUITS is accessible at http://go.nasa.gov/nasasuits.

operations. The addition of a dynamic visual display system on the Exploration Extravehicular Mobility Unit helmet uses AR technology as a tool to help provide astronauts with systematic instructions on tasks, support scientific tasks, visualize consumables, enable interfacing with lunar payloads, streamline crew-to-crew communication, support Mission Control Center interaction methods, and navigate terrain. SUITS teams explore solutions for path planning and navigation and advanced camera/imagery processing functions that contribute to efficiencies in collecting scientific data during EVAs.

Advancement of Agency Mission: Student contributions to NASA are multi-dimensional in nature, including innovative solutions, the ability to demonstrate the utility of new technologies, and the resources trained interns provide to NASA. The research and development conducted by participants in this activity is contributing to the overall research base for the uses of AR and initiating new opportunities for research funding at higher education institutions. New research conducted by the higher education institution students and faculty informs the work of the NASA Community and the STEM workplace at large. Because AR is an as-yet nascent area of technological development for NASA, students provide opportunities for low-cost, low risk options for pursuing untested innovations. SUITS interns have also been credited with intellectual contributions. SUITS has supported projects for over twenty student interns in collaboration with the Human Interface, Informatics, and Subsystems subject matter experts (SMEs). SUITS provides a high-quality internship and NASA workforce development experience resulting in a pipeline of new hires, including Pathways conversions to civil service with NASA, NASA civil service hires, and hires in private industry.

Plan for Upcoming Two Fiscal Years: The agency plans to continue the implementation of this challenge in FY23 and FY24.

B.10.37.   Space Apps 2021[216]

Sponsoring Agency and Office: Science Mission Directorate

Authority: 51 USC 20113(e) NASA Space Act

Competition Summary: Space Apps is the world's largest annual global hackathon. It is an international event for people of all ages, backgrounds, and skills including coders, artists, scientists, designers, storytellers, makers, builders, and technologists in cities around the world. Individuals form teams that engage with the National Aeronautics and Space Administration's free and open data to address real-world problems on Earth and in space.

Advancement of Agency Mission: Space Apps advanced NASA's mission by inspiring collaboration, creativity, and critical thinking; fostering interest in Earth and space science and exploration; raising awareness of NASA data around the world; and encouraging the growth and diversity of the next generation of scientists, technologists, designers, engineers, and artists.

Plan for Upcoming Two Fiscal Years: We expect that the NASA International Space Apps Challenge will occur annually every October.

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[216] The website for Space Apps 2021 is accessible at www.spaceappschallenge.org.

B.10.38.   Space Apps 2022[217]

Sponsoring Agency and Office: Science Mission Directorate

Authority: (51 USC 20113(e)(NASA Space Act))

Competition Summary: Space Apps is the world's largest annual global hackathon. It is an international event for people of all ages, backgrounds, and skills including coders, artists, scientists, designers, storytellers, makers, builders, and technologists in cities around the world. Individuals form teams that engage with the National Aeronautics and Space Administration's free and open data to address real-world problems on Earth and in space.

Advancement of Agency Mission: Space Apps advanced NASA's mission by inspiring collaboration, creativity, and critical thinking; fostering interest in Earth and space science and exploration; raising awareness of NASA data around the world; and encouraging the growth and diversity of the next generation of scientists, technologists, designers, engineers, and artists.

Plan for Upcoming Two Fiscal Years: We expect that Space Apps will occur annually every October.

B.10.39.   Spacecraft Docking Adapter with a Flexible but Load-Bearing Floor[218]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: NASA sought designs for a flexible but load-bearing floor for use in both microgravity and gravity as part of a docking system that can articulate to dock elements that are not perfectly aligned. The challenge was administered by GrabCAD and received 56 entries from 23 countries. Five winners were awarded.

Advancement of Agency Mission: The challenge results will inform NASA's development of a multi-gravity active-active mating adapter (MGAAMA).

Plan for Upcoming Two Fiscal Years: N/A

B.10.40.   Student Launch Challenge[219]

Sponsoring Agency and Office: Human Exploration and Operations Mission Directorate

Authority: Procurement

Competition Summary: Student Launch, one of eight Artemis Student Challenges, reaches a broad audience of colleges, universities, and secondary institutions across the nation in a 9-month commitment to design, build, launch, and fly a payload(s) and vehicle components that support NASA research on high-power rockets. The College/University Division teams are challenged to design a payload that addresses an annual NASA-identified payload challenge. High School/Middle School

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[217] The website for Space Apps 2022 is accessible at www.spaceappschallenge.org.

[218] The website for Spacecraft Docking Adapter with a Flexible but Load-Bearing Floor is accessible at https://grabcad.com/challenges/nasa-challenge-spacecraft-docking-adapter-with-a-flexible-but-load-bearing-floor.

[219] The website for Student Launch Challenge is accessible at https://www.nasa.gov/stem/studentlaunch/home/index.html.

Division teams may elect to tackle the College/University Division challenge, or they may design their own science or engineering experiment. After a competitive proposal selection process, teams complete a series of design reviews that mirror the NASA engineering design lifecycle. Teams must successfully complete a Preliminary Design Review (PDR), Critical Design Review (CDR), and Flight Readiness Review (FRR), which include safety briefings, analysis of vehicle and payload systems, and flight test data. Teams undergo a Launch Readiness Review (LRR) prior to launching at the Huntsville launch event. Teams present their PDR, CDR, and FRR to a review panel of scientists, engineers, technicians, and educators via video teleconference. Review panel members, the Range Safety Officer (RSO), and Subject Matter Experts (SME) provide feedback and ask questions in order to increase the fidelity between the team's work and research objectives. Each College/University Division team is scored according to a standard scoring rubric. High School/Middle School Division teams complete the same milestones but are not in competition and are not scored.

Advancement of Agency Mission: NASA Student Launch is a student challenge and does not offer a government funded prize purse; the entirety of the prize purse is provided by sponsors. The primary objectives relate to education and career preparation; however, unique student designs could inspire NASA solutions to real-world problems. An Annual Technology Report is prepared by project management and provided to the NASA Space Operations Mission Directorate, highlighting innovative payload and vehicle designs.

Plan for Upcoming Two Fiscal Years: NASA Student Launch has been offered continually since 2000. The challenge is expected to continue in FY23 and FY24.

B.10.41.   Trash-to-Gas Ash Management Challenge[220]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: NASA sought ash removal processes for a trash-to-gas reactor that would enable more sustainable space travel. The challenge was administered by HeroX and received 58 submissions from 13 countries. Three winners were awarded.

Advancement of Agency Mission: The challenge results will inform NASA's efforts to mitigate waste during long-duration space exploration.

Plan for Upcoming Two Fiscal Years: N/A

B.10.42.   Ultralight Starshade[221]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: NASA sought design for an ultralight Starshade structure to support the NASA Advanced Innovative Concepts study called the Hybrid Observatory for Earth-like Exoplanets (HOEE). The challenge was administered by GrabCAD and received 60 submissions. Five winners were awarded.

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[220] The website for Trash-to-Gas Ash Management Challenge is accessible at https://www.herox.com/trashtogas.
[221] The website for Ultralight Starshade is accessible at https://grabcad.com/challenges/nasa-challenge-ultralight-starshade-structural-design.

Advancement of Agency Mission: The designs will inform the HOEE study team as they further develop their concept.

Plan for Upcoming Two Fiscal Years: N/A

B.10.43. Unmanned Aircraft Systems Ground Control Station Software[222]

Sponsoring Agency and Office: Aeronautics Research Mission Directorate

Authority: Procurement

Competition Summary: NASA needed a Ground Control Station (GCS) software for small unmanned aircraft systems (sUAS; i.e., drones) that can be safely used for live flight operations while also providing the functionality necessary for researching advanced human-automation teaming concepts. The challenge was administered by Topcoder and received 92 entries from 58 countries. Forty-seven winners were awarded.

Advancement of Agency Mission: The challenge results will aid in NASA's development of its Ground Control Station software.

Plan for Upcoming Two Fiscal Years: N/A

B.10.44. Waste to Base Materials Challenge: Sustainable Reprocessing in Space[223]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: Procurement

Competition Summary: NASA sought concepts for how to most effectively convert waste from lunar operations into materials needed for other lunar activities, such as propellant for spacecraft or feedstock for 3D printing. The challenge was administered by HeroX and received 256 submissions from 41 countries. Twenty-two winners were awarded.

Advancement of Agency Mission: The challenge results will inform NASA's waste management efforts for future long-duration space exploration.

Plan for Upcoming Two Fiscal Years: N/A

B.10.45. Watt On the Moon[224]

Sponsoring Agency and Office: Space Technology Mission Directorate

Authority: NASA Prize Authority

Competition Summary: NASA's Watts on the Moon Challenge seeks solutions for energy distribution, management, and/or storage that address NASA technology gaps and can be further developed for space flight and future operation on the lunar surface. Not only could novel solutions make a difference

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[222] There was no website provided for Unmanned Aircraft Systems Ground Control Station Software.

[223] The website for Waste to Base Materials Challenge: Sustainable Reprocessing in Space is accessible at https://www.herox.com/WasteToBase.

[224] The website for Watt On the Moon is accessible at https://www.nasa.gov/directorates/spacetech/centennial_challenges/watts-on-the-moon/index.html; https://www.herox.com/WattsOnTheMoon.

in lunar and space exploration, but technologies discovered during NASA's Watts on the Moon competition could help facilitate new power options on Earth. The Artemis missions will require lunar surface power systems that can deliver continuous, reliable power to support various industrial activities as well as human habitation. New technologies and systems will be needed to address these needs. Specifically, NASA has identified two critical gaps for lunar surface power systems. For one, NASA will require power transmission that can deliver power from a remote generation source to critical mission operation loads, where power loads are frequently or permanently immersed in extreme cold. Additionally, there are large variations in average power loads versus peak power loads. NASA has significant interest in both wired and wireless transmission, and the challenge seeks to incentivize and demonstrate both types of solutions. NASA seeks Energy Storage that can power mission operation loads when power generation is not available and survive and operate in extreme cold environments. Given that NASA will likely need to transport power systems to the lunar surface, maximizing system efficiency and minimizing system mass will be important to addressing both gaps.

Advancement of Agency Mission: Phase 2 will challenge the teams to test their designs and concepts to demonstrate their ideas, which will help us learn more about possible solutions for lighting the lunar surface. Not only could these award-winning concepts be made into technology demonstrations that make a difference in space exploration, but technologies discovered during the competition could drive clean energy innovation and make a positive impact on Earth.

Plan for Upcoming Two Fiscal Years: N/A

B.11. National Science Foundation (NSF)

B.11.1. Community College Innovation Challenge (CCIC)[225]

Sponsoring Agency and Office: Directorate for Education and Human Resources

Authority: Unknown

Competition Summary: The Community College Innovation Challenge (CCIC) is led by the American Association of Community Colleges (AACC) in partnership with the National Science Foundation (NSF). It is a national competition where community college student teams, working with a supportive faculty or administrator mentor, use science, technology, engineering, and mathematics (STEM) to innovate solutions to real-world problems; earn full travel support to attend an Innovation Boot Camp in the Washington, D.C. metro area; and compete for cash awards. The Innovation Boot Camp provides professional development, mentoring, and coaching designed to build strategic communication and entrepreneurial skills to help students advance their innovations in both the private and public sectors. Students participate in sessions on commercializing ideas, using technology for social applications, communicating with stakeholders, refining a pitch, and more. The Innovation Boot Camp culminates in a poster session and engagement opportunity with STEM leaders and Congressional stakeholders, and a pitch presentation in front of a panel of esteemed industry and entrepreneurial professionals to determine the first, second, and third place winning teams.

Advancement of Agency Mission: The CCIC supports the goals of NSFs Advanced Technological Education (ATE) program by nationally advancing the knowledge and understanding of STEM technician education fields and their role in ideation and innovation. The CCIC enriches and supports

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[225] The website for Community College Innovation Challenge (CCIC) is accessible at www.aaccinnovationchallenge.com.

students in learning employability skills; cultivates STEM innovations that translate knowledge into action; and provides professional development opportunities for student and faculty teams. CCIC participation prepares students with workplace skills; offers pathways to student completion and employment; and provides an opportunity to create STEM-based products and services of potential benefit to society. The CCIC contributes to enabling the U.S. to remain a global leader in STEM literacy, innovation, and employment by nurturing student-faculty collaborations and providing a venue for leadership development and technical assistance. The CCIC also impacts the value and national significance of community college leadership in STEM innovation, entrepreneurship, and meeting the rising demand for a highly-skilled U.S. workforce.

Plan for Upcoming Two Fiscal Years: The Community College Innovation Challenge will be held in FY23 as part of a no-cost extension as funds were remaining in the NSF ATE grant due to the cancellation of the FY20 competition on account of the pandemic.

B.12.   U.S. Agency for International Development (USAID)

B.12.1.   Artisanal Mining in the Amazon Grand Challenge[226]

Sponsoring Agency and Office: Peru Environment and Sustainable Growth (ESG) Office

Authority: (Foreign Assistance Act of 1961, as amended)

Competition Summary: Artisanal and small-scale gold mining (ASGM) is a major threat to biodiversity across the Amazon region, causing habitat destruction, sedimentation, and mercury bioaccumulation that harms human health and ecosystems. The U.S. Agency for International Development (USAID), with Conservation X Labs (CXL), are engaging with innovators and the private sector in developing and implementing solutions to help make ASGM operations more environmentally responsible and socially equitable. CXL has launched a new Amazon Region focused Grand Challenge in partnership with USAID. This activity will complement ongoing USAID bilateral efforts related to artisanal and small-scale gold mining. During FY 2022, the ASGM Grand Challenge received 121 applications from 22 countries. After an extensive evaluation process including over 50 experts in ASGM, entrepreneurship, conservation, and business development, 22 teams were shortlisted and invited to submit field-testing applications. After an additional evaluation period of the shortlisted teams' technical applications and field-testing applications, twelve innovator teams were named Challenge Finalists, invited to the second phase of the ASGM Grand Challenge, and received $50,000 for field-testing their innovation. At the close of the activity, it is expected that four solutions will be fully funded for the accelerator and scale services that fit their needs. The Global Development Alliance (GDA) will leverage significant investments made by the Gordon and Betty Moore Foundation, Microsoft, and Esri.

Advancement of Agency Mission: The purpose of the ASGM Grand Challenge is to engage the private sector in the development and implementation of innovations to make artisanal, small-scale and informal gold mining operations more environmentally responsible and socially equitable in the countries where USAID's Amazon Regional Environment Program operates. This activity will complement ongoing USAID bilateral efforts related to ASGM . By focusing the ASGM Grand Challenge on the Amazon basin, innovators can be supported to advance solutions, reach new markets, and secure partnerships, bringing awareness of potential solutions for artisanal mining to governments and

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[226] The website for Artisanal Mining in the Amazon Grand Challenge is accessible at https://www.artisanalminingchallenge.com/.

institutions throughout the Amazon. Finally, promising innovations will be scaled via an accelerator program to have impact throughout the Amazon basin.

Plan for Upcoming Two Fiscal Years: N/A

B.12.2. Begin with Books[227]

Sponsoring Agency and Office: Washington - USAID/DDI/EDU

Authority: Foreign Assistance Act of 1961 as amended

Competition Summary: Learning to read is transformative and impacts a child's lifelong opportunity to reach their full potential. However, around 250 million children of primary school age around the world are unable to recognize basic letters and numbers, even though half of students have spent at least four years in school. Despite the importance of books in boosting foundational literacy skills, there is a global shortage of books for children. For the estimated 19 million children globally that are blind or have low vision or the millions of children with other disabilities that impact their use of traditionally printed material, the shortage of quality books in accessible formats is even more severe. With a mission devoted to ensuring all children have access to books, All Children Reading: A Grand Challenge for Development is collaborating with the Global Book Alliance (BA) to launch the Begin with Books Prize, a competition challenging global innovators to assemble cost effective packages of high quality, accessible titles in more than 30 underserved spoken and signed languages. Winning innovators will upload the titles to the Global Digital Library (GDL), a free web-based platform that will make high-quality early learning resources available in more than 100 languages. Beginning with books, we can ensure more children are prepared to reach their full potential -- while simultaneously accelerating progress across multiple development goals.

Advancement of Agency Mission: ACR GCD has partnered with School to School International to conduct external evaluations of all awards. All evaluation reports will be widely disseminated to contribute to partner and agency research and learning agendas.

Plan for Upcoming Two Fiscal Years: The prize competition will be completed on September 30, 2023.

B.12.3. BetterTogether Challenge[228]

Sponsoring Agency and Office: Washington

Authority: Foreign Assistance Act of 1961, as amended

Competition Summary: The BetterTogether / JuntosEsMejor Challenge is a global initiative to crowdsource, fund, and scale forward-thinking solutions from Venezuelans, wherever they are, and innovators worldwide to support Venezuelans and host communities affected by the regional crisis. The U.S. Agency for International Development and the Inter-American Development Bank launched this Challenge in October 2019 in order to: elevate Venezuelan voices and ingenuity to convey and answer their needs across the region; connect Venezuelans, host communities, and the world's collective genius to develop innovative solutions; expand networks across communities and countries to

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[227] The website for Begin with Books is accessible at https://allchildrenreading.org/competition/begin-with-books/.

[228] The website for BetterTogether Challenge is accessible at https://juntosesmejorve.org/.

promote relationships and collaboration; fund, test and scale solutions; and build a marketplace of tested, market-ready solutions.

Advancement of Agency Mission: The BetterTogether / JuntosEsMejor Challenge was launched by USAID in partnership with the Inter-American Development Bank to achieve critical humanitarian and development goals around the Venezuelan regional crisis. To this end, BetterTogether provided customized support across a breadth of areas to help organizations establish long-term partnerships and attract additional investment to scale their innovations. Almost all the solutions (88 percent) tested and proven under the challenge are leveraging long-term partnerships and support beyond challenge funding to support scaling, and 84 percent of them have concrete plans to continue doing so. Of the total solutions, 50 percent have been supported or adopted by the private or public sector during their grant.

Plan for Upcoming Two Fiscal Years: N/a

B.12.4. Brucellosis Vaccine Challenge Project[229]

Sponsoring Agency and Office: Washington

Authority: Unknown

Competition Summary: Prevalent in developing countries, Brucella melitensis is a strain of Brucellosis that particularly affects small ruminants such as goats and sheep. The Brucellosis Vaccine Challenge Project is a US$30 million Pay-for-Results prize contest launched in 2016 that aims to incentivize animal health companies to develop a vaccine against Brucella melitensis. Eligible companies can receive three milestone payments at different stages that could add up to a total of US$26 million for one entrant over the span of up to ten years.

Advancement of Agency Mission: Zoonotic diseases such as brucellosis have devastating effects on food security and livelihoods. The existence of a readily available and effective vaccine will improve resilience.

Plan for Upcoming Two Fiscal Years: None reported

B.12.5. CHIC Shift Prize[230]

Sponsoring Agency and Office: Washington

Authority: Innovation Incentive Award authority (IIAA)

Competition Summary: The SHIFT Prize is an opportunity for Grand Challenges Canada and USAID to recognize and incentivize innovators from the Creating Hope in Conflict: A Humanitarian Grand Challenge (HGC) portfolio that apply systems-thinking and systems-acting to their work. In response to an historic underinvestment in woman-led and locally-owned innovation, the prize recognizes and incentivizes women-led and locally-owned humanitarian innovations from HGC's flagship humanitarian innovation portfolio. The problems that humanitarian innovations seek to address are complex, extending far beyond the technical design of a solution. Each solution is part of a system, and

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[229] The website for Brucellosis Vaccine Challenge Project is accessible at https://agresults.org/projects/brucellosis-global.

[230] The website for CHIC Shift Prize is accessible at https://humanitariangrandchallenge.org/wp-content/uploads/2022/08/Shift-Prize-Call-28-July-2022-1.pdf.

every system includes economic, political, social, cultural and environmental realities that need consideration for the innovation to work. This prize seeks to influence how innovators build and cultivate a complete system around their solution, as well as how the system around the innovation delivers more equitable value for conflict-affected communities. USAID will award two prizes for innovators that demonstrate the most complete systems engagement and the most compelling foundation for contributing to systems change.

Advancement of Agency Mission: This prize will drive agency learning on how to support innovation teams to work effectively within the complex system where they operate. Ultimately, it will support more relevant humanitarian innovations. The emphasis on women-led and locally-owned innovation also fits into the Agency's goals on inclusivity and localization.

Plan for Upcoming Two Fiscal Years: N/A

B.12.6. CLA Case Competition[231]

Sponsoring Agency and Office: Washington

Authority: Unknown

Competition Summary: In 2012, USAID developed its own holistic and evidence-based approach to organizational learning and adaptive management in the development context, called Collaborating Learning and Adapting (CLA) - the first of its kind among donors. CLA has since become a prominent component of Agency policy, guidance and training. Since 2015, USAID's Bureau for Policy, Planning and Learning has organized an annual case competition open to USAID staff and partners to share examples of collaborating, learning, and adapting in action. It provides concrete examples of CLA practices and approaches, exactly how they were implemented, and how they improved development outcomes, in order for these practices and approaches to be adopted by USAID staff and partners throughout the world. Beyond the direct benefits of the competition itself, the annual submissions are stored in a publicly accessible database, contributing directly to Agency learning.

Advancement of Agency Mission: The CLA Case Competition submissions have been collected in an online library that is publicly available. In addition, cases— either the cases themselves or the organizations which submitted the cases—have been incorporated into events and training events throughout the Agency. For example, case competition winners were highlighted in an event on localization and have been highlighted in various newsletters. Case competition submissions have also been incorporated into agency training curricula.

Plan for Upcoming Two Fiscal Years: The next iteration of the CLA Case Competition is expected to launch in spring 2023, with judging completed in summer 2023 and winners announced in September. Concrete timelines have not yet been planned for 2024.

B.12.7. Countering Transnational Corruption Grand Challenge[232]

Sponsoring Agency and Office: Washington

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[231] The website for CLA Case Competition is accessible at https://usaidlearninglab.org/community/cla-case-competition.

[232] The website for Countering Transnational Corruption Grand Challenge is accessible at https://www.usaid.gov/anti-corruption/countering-transnational-corruption-grand-challenge.

Authority: Unknown

Competition Summary: As the vanguard of USAID's suite of anti-corruption programs in the Presidential Initiative for Democratic Renewal, the Countering Transnational Corruption Grand Challenge for Development (CTC Grand Challenge) leverages innovation and collaboration to prevent corrupt actors from siphoning off critical resources that should be used for the public good. The CTC Grand Challenge solutions will detect and disrupt illicit finance and trafficking in commodities; strengthen transparency and accountability in global supply chains; promote standards, practices, and norms that enhance integrity in the public and private sectors; and address other significant dynamics of transnational corruption. We will do so by harnessing the power of both novel and proven approaches, tools, and technologies; mobilizing and leveraging the private sector; partnering with local solvers and influencers; and fostering collective action through diverse networks.

Advancement of Agency Mission: USAID will use the results of its various activities under the CTC Grand Challenge to test new approaches that address corruption, to scale solutions that work, and to build further knowledge on investing in and integrating anti-corruption measures in ongoing programming. These results will help USAID strategically partner and continue its work in the anti-corruption space.

Plan for Upcoming Two Fiscal Years: USAID will implement the JET Minerals Challenge for FY 22-25. Other anticipated activities are yet to be determined.

B.12.8.   Creating Hope in Conflict: a Humanitarian Grand Challenge[233]

Sponsoring Agency and Office: Washington

Authority: Section 491 of the Foreign Assistance Act of 1961

Competition Summary: Creating Hope in Conflict: A Humanitarian Grand Challenge (HGC) is a multi-partner initiative, co-led by USAID's Bureau for Humanitarian Assistance (BHA), that works to transform the way humanitarian assistance is provided by identifying, testing, and piloting new solutions that improve the delivery of humanitarian assistance to the most vulnerable and hardest-to-reach people affected by conflict. The HGC focuses on providing solutions to challenges across the energy, water and sanitation, health, and life-saving information sectors. The HGC envisions a world where new systems, processes, technologies and other solutions equip conflict-affected communities to mitigate the impacts of humanitarian crises caused by conflict. The HGC is a partnership between USAID's Bureau for Humanitarian Assistance, the UK's Foreign Commonwealth and Development Office, the Netherlands' Ministry of Foreign Affairs, and Global Affairs Canada, and is implemented by the non-profit Grand Challenges Canada

Advancement of Agency Mission: The Creating Hope in Conflict: A Humanitarian Grand Challenge identifies and supports groundbreaking solutions that engage the private sector and draw from the experiences of affected communities in order to significantly improve and, in many cases, save the lives of vulnerable people affected by conflict. The goal is to identify solutions that allow communities to respond more nimbly to complex emergencies and take steps to create better lives for themselves, which is directly in line with USAID's efforts to improve the efficiency and effectiveness of its humanitarian assistance activities and to support the implementation of USAID's private sector engagement and localization strategies.

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[233] The website for Creating Hope in Conflict: a Humanitarian Grand Challenge is accessible at https://humanitariangrandchallenge.org.

Plan for Upcoming Two Fiscal Years: USAID/BHA intends to continue supporting Creating Hope in Conflict: a Humanitarian Grand Challenge with Round 4 of seed innovations and to complete the current round of Transition to Scale to support innovations in conflict-affected regions.

B.12.9. Disrupt Senegal[234]

Sponsoring Agency and Office: Overseas

Authority: USAID Entrepreneurship and Investment activity

Competition Summary: The Disrupt Senegal Contest is a youth technology competition initiated by USAID to promote entrepreneurship and increase access to key services for enterprises growth. The initiative is an opportunity to celebrate the creativity and engagement of young Senegalese entrepreneurs who provide solutions on challenges faced by the population around seven areas namely: water, sanitation and hygiene (WASH); agriculture; health; gender inclusion; creative industry; environment; and climate issues. This contest is initiated under the five-year USAID Entrepreneurship & Investment activity that is aiming to increase investment and generate employment throughout Senegal by supporting the market for business development, financial, and investment services. USAID Entrepreneurship & Investment partnered with government agencies and other private and civil society partners, who sponsored this initiative by providing financial or in-kind assistance to the finalists. In addition to these awards, there are also technical support services envisioned for the laureates after the award ceremony, including coaching by prominent business leaders to help improve or scale the solutions.

Advancement of Agency Mission: All seven prizes of the Senegal Disrupt Contest are related to USAID's key sectors of intervention. By promoting solutions in these sectors, USAID is advancing its development objective. The two other aspects of the contest placed youth and women at the forefront, giving them the opportunity to showcase their inventions and receive technical or financial support from other actors. The second aspect is related to the USAID approach of putting the private sector at the core of its interventions. This initiative reinforces USAID private sector engagement and is placing the agency as a key partner in the ecosystem.

Plan for Upcoming Two Fiscal Years: For the coming fiscal years, USAID Entrepreneurship & Investment is planning to have other activities similar to the youth technology contest organized during FY2022. In addition to the Disrupt Senegal Contest that targets start-ups in testing and scaling phase of their business innovation, another youth contest will be organized to stimulate entrepreneurial mindset among youth aged between 15 to 24. This one will focus on business ideas rather than already started projects. Finally, an agri-lab in the form of a hackathon is planned during FY2023. This activity will gather young inventors who will work to provide a solution to an agriculture specific problem: the mechanization of the dispersion of fertilizers. All these activities will be co-created with the government of Senegal and private sector actors.

B.12.10. Eastern Caribbean Business Resilience Challenge[235]

Sponsoring Agency and Office: Washington

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[234] There was no website provided for Disrupt Senegal.
[235] The website for Eastern Caribbean Business Resilience Challenge is accessible at https://www.usaid.gov/eastern-caribbean-business-resilience-challenge.

Authority: International Disaster Assistance

Competition Summary: On average, Small Island Developing States (SIDS) suffer yearly losses from storm damages equivalent to 17% of their GDP. The most severe storm ever, in terms of per capita damage, hit Dominica in 2017, causing damage equivalent to 280% of the country's GDP. After such shocks, these nations must rebuild, with limited resources and capacity, just to get back to their previous economic activity and infrastructure capacity baselines. Countries in the Eastern Caribbean face significant economic challenges, e.g. geographic size and markets, a lack of creditor trust, chronic debt, weak economic diversification, and low productivity. Compared to larger states, IMF research shows the region is up to seven times more likely to experience a natural disaster and suffer six times as much damage when disasters transpire. The goal of this activity is to increase disaster resilience in the Eastern Caribbean by supporting businesses and initiatives with sound economic models. Providing funding into their operations and value chains can ultimately scale their economic growth, sustainability, and resilience, thereby strengthening communities. Our solution will use blended finance to mobilize capital for investment, providing social and economic returns for local businesses and communities.

Advancement of Agency Mission: By using blended capital to de-risk opportunities and facilitate investments into critical sectors and value chains, we can increase resilience to disasters in targeted economies in the Eastern Caribbean. The Blended Finance mechanism will allow more private capital to flow towards investments in resilience, contributing to sustainability after the end of grant funding. Further, the private sector (particularly SMEs) will become more resilient to disasters, and a more resilient private sector will promote broader economic recovery. These economies and communities will have the ability to recover from disasters more rapidly and effectively.

Plan for Upcoming Two Fiscal Years: n/a

B.12.11. Equitable AI[236]

Sponsoring Agency and Office: Washington

Authority: Launched under the FAR using Assistance authority

Competition Summary: As the use of artificial intelligence (AI) proliferates, more instances of the inequitable design, use, and impact of AI-enabled tools in developing countries are coming to light. Many of these tools and approaches can generate inequitable outcomes across genders due to bias embedded in AI technology through data collection, model design, or end-use applications. These tools often pose the greatest risk of harm and missed opportunities to those who have historically been subject to bias. These inequities require creative solutions to ensure that everyone has a chance to benefit from AI technology. To foster an equitable and inclusive digital ecosystem, more efforts are needed to identify innovative and timely approaches to help decision-makers address gender biases, harms, and inequitable outcomes resulting from AI technology. The goal of USAID's Equitable AI Challenge, in alignment with USAID's AI Action Plan, is to help AI practitioners around the world better prevent and respond to gender inequity caused by AI, and increase accountability of AI systems to produce more gender-equitable results. Through the Equitable AI Challenge, USAID is investing in innovative approaches to help identify and address actual and potential gender biases in AI systems relevant in global development contexts. USAID is seeks to supporting approaches to increase the

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[236] The website for Equitable AI is accessible at https://www.usaid.gov/innovation/competitions/equitable-ai-challenge.

prevention, identification, transparency, monitoring, and accountability of AI systems so that their outputs do not produce gender-inequitable results.

Advancement of Agency Mission: The results will support USAID's AI Action Plan by committing to responsible AI, stregnthening AI ecosystems in our partner countries, and strengthening our relationships with relevant AI-related organizations around the world. It will also contribute to an evidence base for promoting responsible, gender-equitable AI from real projects in different geographic and cultural contexts.

Plan for Upcoming Two Fiscal Years: N/A Hoping to launch a round 2 of the Equitable AI Challenge in FY23 or FY24 pending internal funding deliberations

B.12.12.   Foot and Mouth Disease Vaccine Challenge Project[237]

Sponsoring Agency and Office: Washington

Authority: Unknown

Competition Summary: The AgResults Foot and Mouth Disease (FMD) Vaccine Challenge Project is an eight-year, US$17.68 million prize competition that encourages the development and uptake of high-quality FMD vaccines tailored to meet the needs of Eastern Africa. The prize is structured as a cost-share that reduces the cost-per-dose for buyers, enabling public and private sector actors to better combat FMD through more consistent purchases of these vaccines. In this way, the project can create a market around an effective solution that will improve animal health and strengthen farmer livelihoods. GALVmed serves as the Project Manager.

Advancement of Agency Mission: FMD has the potential to have devastating effects on food security and livelihoods. The development of a regionally-relevant vaccine and a market to lead to stable availability would increase resilience.

Plan for Upcoming Two Fiscal Years: None reported

B.12.13.   Grand Challenge for Development: Expanding Womens Access to Commercial Finance[238]

Sponsoring Agency and Office: Washington

Authority: Federal Acquistion Regulation (acquisitions authority)

Competition Summary: In August 2020, USAID/Gender's Equality and Women's Empowerment Hub (GenDev) and the Innovation, Technology and Research Hub launched a challenge to increase women's access to commercial finance in Antioquia, Colombia. Women's access is frequently restricted by barriers in the form of restrictive laws, regulations, policies, administrative practices, and social norms. This challenge was designed to break these barriers by convening stakeholders to create and implement locally led solutions that support partnerships between financial entities, financial intermediaries, business support service providers, and community organizations to improve financial and non-financial services for rural women, including those impacted by conflict. USAID identified three

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[237] The website for Foot and Mouth Disease Vaccine Challenge Project is accessible at https://agresults.org/projects/fmd-vaccine.

[238] The website for Grand Challenge for Development: Expanding Womens Access to Commercial Finance is accessible at https://sites.google.com/designthinkersgroup.us/granreto.

cross-cutting consortia of partners, led by Microempresas, Fundacion Capital, and CONFAMA, that will test new financial products and build new coalitions to create opportunities for women and a more inclusive financial system.

Advancement of Agency Mission: USAID is already using insights from the Grand Challenge for Development: Expanding Women's Access to Commercial Finance to mainstream solutions from the challenge by including follow-on activities in subsequent programming for women's economic empowerment in Colombia. Furthermore, USAID/Nepal is considering a similar approach as part of their women's economic security portfolio. Finally, USAID's Exploratory Programs and Innovation Competitions team has learned the benefits and drawbacks of this approach (including the challenges of a virtual collaborative convening) and we are infusing these lessons learned into future recommendations to USAID teams considering a Whole Systems in a Room collaborative convening.

Plan for Upcoming Two Fiscal Years: USAID plans to launch or oversee numerous prizes, challenges, and Grand Challenges, including several that address issues including women and girl's economic security and women girl's full and secure participation in public life.

B.12.14. Indonesia Aquaculture Challenge Project[239]

Sponsoring Agency and Office: Washington

Authority: Unknown

Competition Summary: The AgResults Indonesia Aquaculture Challenge Project is a four-year, US$4.9 million prize competition that aims to strengthen the country's aquaculture sector by encouraging private sector actors to drive smallholder farmer adoption of on-farm technologies such as feeders and aerators. By providing a prize for each aerator or feeder sold or rented, the competition aims to increase productivity, boost farmer income, and strengthen value chain relationships between aquaculture input providers and farmers. In addition to engaging input providers, the competition will also encourage hatcheries to receive IndoGAP certification for a separate prize. WWF-Indonesia serves as the Project Manager.

Advancement of Agency Mission: Increased consumption of aquaculture products can have large, positive impacts on consumer nutrition and a stronger market for these products will increase small producer income.

Plan for Upcoming Two Fiscal Years: None reported

B.12.15. Intelligent Forecasting Competition[240]

Sponsoring Agency and Office: Washington

Authority: Innovation Incentive Award Authority

Competition Summary: In low- and middle-income countries (LMIC) around the world, health systems struggle to accurately predict the quantities of contraceptives that are needed at each public sector service delivery site for use by clients seeking family planning services. This leads to inefficient ordering

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[239] The website for Indonesia Aquaculture Challenge Project is accessible at https://agresults.org/projects/indonesia-aquaculture.

[240] The website for Intelligent Forecasting Competition is accessible at https://www.usaid.gov/global-health/health-areas/family-planning/usaids-intelligent-forecasting-competition-model-future.

and distribution of contraceptives to service delivery sites and can ultimately result in stockouts, stock shortages, or overstock. This under- and over-stocking leads to reduced access to contraceptives for users, inefficient allocation of resources in the supply chain, and potential loss of product due to expiration. There are many reasons why predictions about consumption of contraceptives at facilities may be flawed. These include: limited availability or low-quality data, limited staff capacity, limited staff time, and weak business processes. Across most LMIC public sector health systems, one key limitation is that historically, facilities have ordered based on calculations that primarily or exclusively rely on logistics data from previous time periods to predict future consumption. However, evolving health systems and digital infrastructure have created an opportunity to utilize advanced methods to more accurately predict future contraceptive needs, even for short-term forecasts for service delivery sites. The Intelligent Forecasting Competition seeks to encourage innovation and drive progress through intelligent forecasting methods to predict contraceptive consumption at the service delivery level of the public sector health system in Côte d'Ivoire.

Advancement of Agency Mission: The USAID Office of Population and Reproductive Health (PRH) supports voluntary family planning and reproductive health programs in nearly forty countries. A key component in this work is to support Ministries of Health and service delivery partners to better predict, procure, allocate, transport, and distribute contraceptives. Greater access to contraceptives enables couples and individuals to determine whether, when, and how often to have children. Contraceptive access is vital to safe motherhood, healthy families, and prosperous communities. Accurate forecasting of contraceptive consumption can save lives, money, and time by ensuring health service delivery sites have what they need when they need it and by reducing waste in the supply chain. The prize competition is expected to improve the ability to accurately forecast contraceptive needs at service delivery points, and to supply appropriate quantities of contraceptives.

Plan for Upcoming Two Fiscal Years: N/A

B.12.16. JET Minerals Challenge[241]

Sponsoring Agency and Office: Washington

Authority: Unknown

Competition Summary: The Powering a Just Energy Transition Green Minerals Challenge (JET Minerals Challenge) incentivizes the development, application, and scaling of innovations that root out corruption in green mineral supply chains to fulfill the promise of an inclusive, sustainable, and just clean energy future. The JET Minerals Challenge sought early stage ideas, prototypes, and/or proven solutions seeking validation and scaling that target and reduce corruption across green mineral supply chains. This call for innovations will identify solutions that counter corruption and strengthen transparency, accountability, and integrity in the global rush to meet the unprecedented demand for green minerals.

Advancement of Agency Mission: The results of the JET Minerals Challenge will help to support USAID's broader portfolio of work in the anticorruption and environment spaces—including those related to climate, the just energy transition, and the extractives sector— to ensure that our current and future portfolios address these risks of corruption and to help support the sustainability of solutions funded through the JET Minerals Challenge.

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[241] The website for JET Minerals Challenge is accessible at https://www.challenge.gov/?challenge=jetmineralschallenge.

Plan for Upcoming Two Fiscal Years: The JET Minerals Challenge will continue in FY23, with winning innovators being selected in FY23 and beginning the implementation of their winning solutions, with acceleration support, in FY23-FY25.

B.12.17. Mombasa Plastics Prize[242]

Sponsoring Agency and Office: Overseas - USAID/Kenya & East Africa

Authority: Unknown

Competition Summary: In partnership with the U.S. Department of Interior, Global Affairs Canada, and the Exploratory Programs and Innovation Competitions (EPIC) team at USAID, USAID Kenya and East Africa (USAID/KEA) designed and implemented a prize competition targeting youth from under-resourced communities in Mombasa, Kenya to address the problem of ocean plastic pollution. The prize encouraged innovation and awareness among 57 aspiring entrepreneurs and leaders in Mombasa County by inspiring the development of solutions that tackle the problem of marine plastic waste in informal settlements. In May 2023, three winners were selected from the 14 teams and awarded a combined total of roughly $52,000 USD. The first-place team created a company to recycle marine plastic waste from informal settlements into school eco-decks. The second-place team created simple nets on the back of peddler boats to collect plastic waste in the ocean to repurpose it for art installations.

Advancement of Agency Mission: The prize addresses multiple agency priorities including climate and localization, and additionally elevates the work of youth in Kenya to tackle pressing global challenges including plastic pollution.

Plan for Upcoming Two Fiscal Years: Given the success of the Mombasa Plastics Prize, USAID/KEA is starting a follow-on activity in late summer 2023 consisting of a six-month Business Accelerator Program where up to 9 teams from the prize will be given financial and non-financial support to formalize their businesses while meeting plastic mitigation targets. This will ensure the ideas generated from the Mombasa Plastics Prize become reality.

B.12.18. Mujer Prospera Challenge[243]

Sponsoring Agency and Office: Washington

Authority: NA

Competition Summary: As part of the Biden-Harris Administration's efforts to address the root causes of irregular migration, USAID is sponsoring the MujerProspera (WomanProsper) Challenge, a regional challenge to advance gender equality in El Salvador, Guatemala, and Honduras, which was publicly launched in January 2022 . The challenge integrates holistic and impactful solutions that advance women's economic security, employment, and/or entrepreneurship. The MujerProspera Challenge works at the nexus of: advancing women's economic security by improving working conditions and labor protections, recruitment, retention, promotion, and the advancement of women in dignified, stable work that results in increased access, productivity, and a fair and stable income in the workforce; and addressing harmful gender norms and enabling safe work environments through promoting

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[242] The website for Mombasa Plastics Prize is accessible at https://mombasaplasticsprize.challenges.org/.

[243] The website for Mujer Prospera Challenge is accessible at https://www.usaid.gov/mujer-prospera-challenge.

positive gender norms, egalitarian attitudes and behaviors, a holistic safe working environment, and safe transportation to and from work, supportive of women's economic security and agency. The nine winning organizations were selected for awards based on their innovative and impactful solutions to promote women's agency; safety; access to power, resources, fair and stable long-term income; and labor protections in the workplace. Seven of the nine winners are local partners, three are regional efforts, and all are leveraging private sector support to advance women's economic security and address harmful gender norms . Their intersectional approaches are rooting out systemic barriers and discrimination and addressing the needs of women and girls, particularly those from marginalized and underserved populations.

Advancement of Agency Mission: The MujerProspera Challenge began on the ground implementation in June 2022 and the results will be realized in 2024. The Gender Equality and Women's Empowerment Hub (USAID/DDI/GenDev), the Exploratory Programs and Innovation Competitions team (USAID/DDI/ITR/I/EPIC), and Missions in Guatemala, Honduras and El Salvador will take good practices and lessons learned from the challenge to inform ongoing and future programs focused on women's economic security. There may be opportunities for continued partnerships depending on the success of the grantees' approaches and alignment with USAID's country and regional strategies.

Plan for Upcoming Two Fiscal Years: N/A

B.12.19.   Nigeria COVID-19 Challenge[244]

Sponsoring Agency and Office: Overseas

Authority: Unknown

Competition Summary: Nigeria is facing a food security crisis that is compounded by the COVID-19 global pandemic and its effects on the food value chain in the country. The pandemic has significantly disrupted already fragile value chains across the country, including people's ability to produce, process, and distribute food. The disruption to agricultural productivity and markets has a negative knock-on impact on livelihoods, especially among the most vulnerable households. As part of the Feed the Future initiative, USAID/Nigeria is partnering with 19 youth-led companies and 13 mid-stage companies that are already working in food production, processing, and distribution. USAID has invested $4 million in these partners to help farmers and other stakeholders in the food value chain increase agricultural productivity and food security within the next year to mitigate the effect of COVID-19 on Nigeria's food value chain.

Advancement of Agency Mission: Through rapidly deployed funding and relevant technical assistance, the USAID/Nigeria COVID-19 Food Security Challenge is helping Nigerian small and medium-sized enterprises (SMEs) increase the availability and accessibility of quality agricultural inputs and the use of innovative technologies by smallholder farmers. By increasing agriculture value chain productivity, smallholder farmer incomes, and food security, the COVID-19 Food Security Challenge helps reduce the negative impacts of COVID-19 on Nigeria's Food Security. The challenge funds are being used by SMEs to promote digital platforms such as digitized logistics; improve power and agriculture nexus solutions; increase on-farm mechanization; enhance skills development and youth employment in agricultural value chains; and develop innovative locally available, affordable, and scalable food-based models for

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[244] The website for Nigeria COVID-19 Challenge is accessible at https://www.usaid.gov/innovation/nigeriacovid19.

prevention or treatment of malnutrition in Nigeria. The impacts of the challenge contribute directly to USAID/Nigeria's CDCS and Feed the Futures Results Framework.

Plan for Upcoming Two Fiscal Years: N/A

B.12.20.   RISE Challenge[245]

Sponsoring Agency and Office: Washington

Authority: Unknown

Competition Summary: Gender-based violence (GBV) and environmental degradation—amplified by climate change—are among the world's most critical challenges, both with a complex and widespread impact. Pervasive GBV and environmental destruction affect the security and well-being of nations, communities, and individuals; jeopardize development goals; and contribute to cycles of vulnerability. Ending GBV and securing environmental sustainability are global, interlinked priorities, yet are rarely addressed together. In 2019, the United States Agency for International Development (USAID) commissioned a study from the International Union for Conservation of Nature (IUCN) to explore the ways in which GBV is used to maintain or promote unequal gendered power dynamics surrounding the ownership of, access to, uses of, benefits derived from, and control over natural resources. The research revealed that GBV is pervasive across environmental sectors and is used systematically to control, enforce, and protect existing privileges around natural resources. The report found that opportunities to integrate and address GBV and environmental sustainability together are limited due to a lack of awareness of their correlation, limited evidence-based solutions, and insufficient coordination and collaboration among environmental, gender, and other relevant organizations. In response to these findings, USAID's Gender Equality and Women's Empowerment Hub (GenDev) launched the Resilient, Inclusive, and Sustainable Environments (RISE) Challenge in 2019. Over the past 3 years, the RISE Challenge has funded 9 partnerships that prevented and responded to GBV across multiple environmental contexts and climate-related sectors, including conservation, forestry, artisanal and small-scale mining, and land tenure and property rights in 8 countries. RISE has positively impacted over 14,000 direct beneficiaries and 100,000 indirect beneficiaries.

Advancement of Agency Mission: Responding to GBV can provide opportunities for both enhanced environmental action and women's empowerment, but tackling one issue without addressing the other is unlikely to succeed. USAID's RISE Challenge aims to identify and implement interventions to reduce GBV in environmental programming. This challenge funds organizations to innovatively adapt and implement promising or proven practices that have been used to effectively prevent and respond to GBV in other sectors to environmental programming. The challenge draws insights from other development and humanitarian sectors that have proven or promising practices to address GBV. It incentivizes partnerships between environmental organizations, local communities, indigenous peoples organizations, and gender and GBV experts who can help bridge knowledge gaps and work to build an evidence base of effective GBV interventions. RISE also champions a broad range of interventions that are sustainable and integral to environmental programming and investments from USAID and its partners. The RISE Challenge helps USAID advance their Climate Change Strategy, Gender Equality and Women's Empowerment Policy, and USAID's Policy on Promoting the Rights of Indigenous Peoples.

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[245] The website for RISE Challenge is accessible at https://genderandenvironment.org/agent-gbv-env/rise-challenge/.

Plan for Upcoming Two Fiscal Years: USAID/DDI/GenDev plans to continue implementation of the RISE Challenge in FY23 and FY24. In FY23, the RISE Challenge issued new awards in response to the third open call, with implementation starting in 2023. A fourth round of funding will also be launched mid-year. In FY24, the RISE Challenge will continue to support the implementation of programs, and funds permitting, will launch the fifth call for proposals.

B.12.21. Ready to Read[246]

Sponsoring Agency and Office: Washington - DDI/EDU

Authority: Foreign Assistance Act of 1961, as amended

Competition Summary: Despite several decades of focusing on improving access to quality education for all children, learning outcomes continue to remain low, with fewer than half of the world's school-aged children learning to read on grade level or gaining basic numeracy skills, according to the World Bank. Even though more than 85 percent of a child's brain is developed by age 6, approximately 175 million children globally are not enrolled in pre-primary education. COVID-19 has only exacerbated these challenges, as millions more children have missed out on early childhood education due to closures of childcare and early education facilities due to the pandemic. A growing body of evidence suggests investing in high-quality pre-primary education—providing young children with the foundational skills they need to support grade-level learning—is an effective way to address the global learning crisis. The Ready2Read Challenge calls on global problem-solvers to propose existing or adapted EdTech solutions and activities that enable marginalized children ages 3 to 6 to build foundational language and literacy skills at home and at school. In addition to targeting key foundational language and literacy skills—including alphabetic knowledge, phonological awareness, expressive vocabulary, and listening comprehension—solutions should also support parents, caregivers, teachers and/or facilitators with resources and tools to assist in filling gaps in early learning among children, especially due to COVID-19 and other crises.

Advancement of Agency Mission: ACR GCD has partnered with School-to-School International to conduct external evaluations of all awards. All evaluation reports will be widely disseminated to contribute to partner and agency research and learning agendas.

Plan for Upcoming Two Fiscal Years: The prize competition will be completed on September 30, 2023.

B.12.22. Responsible Computer Science Challenge[247]

Sponsoring Agency and Office: Washington

Authority: Unknown

Competition Summary: As digital tools and services, smartphone adoption, and access to connectivity expand across the world, those who design and deploy digital tools will play an outsized role in how people get access to information and services and interact with each other, with civil society, and with government. To ensure that the digital revolution is equitable and respects the dignity, perspectives,

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[246] The website for Ready to Read is accessible at https://allchildrenreading.org/competition/ready2read-challenge/.

[247] The website for Responsible Computer Science Challenge is accessible at https://foundation.mozilla.org/en/what-we-fund/awards/responsible-computer-science-challenge/.

and rights of all, we must address the foundational challenge of supporting a more responsible, digital-savvy local workforce in the countries where we work. There is an increasing appreciation of the importance of an interdisciplinary approach to teaching computing that takes into account the human and societal consequences of this work. Recognizing this, Mozilla Foundation launched the Responsible Computing Challenge (RCC) to encourage universities to reimagine their undergraduate computer science curricula and introduce a systemic shift in how computer scientists view ethical and responsible design and use of technology . USAID partnered with Mozilla Foundation to expand this work beyond the United States and launch RCCs in India and Kenya. We must invest today to shape the responsible technologists of tomorrow, because the technologists behind such systems and platforms will in turn shape the technologies that will enable access to fundamental services like social programs, loans, jobs, and free and fair information. This work is critical to achieving our goal of fostering open, secure, and inclusive digital ecosystems around the world, and to ensuring a world where digital tools and services reflect democratic and free societies rather than repressive and closed societies.

Advancement of Agency Mission: We do not have results yet. We are in the process of selecting winners for Kenya and are about to launch the Challenge in India. .

Plan for Upcoming Two Fiscal Years: None reported

B.12.23.   Saving Lives at Birth[248]

Sponsoring Agency and Office: Washington

Authority: Unknown

Competition Summary: Saving Lives at Birth (SL@B) is a global partnership between USAID, the Government of Norway, the Bill & Melinda Gates Foundation, Grand Challenges Canada, the U.K. Foreign, Commonwealth and Development Office (formerly DFID), and the Korea International Cooperation Agency (KOICA). SL@B issued its first global call for groundbreaking innovations to be used around the time of birth to reduce maternal and newborn deaths and prevent stillbirths in poor, hard-to-reach communities. Saving Lives at Birth seeks innovative solutions that are affordable, accessible, sustainable, and of high quality across three focus areas: science and technology, service delivery, and demand creation. The partnership chose its first awardees in 2011 and has issued a call for applications and chosen new award recipients in each subsequent year through 2018. In its eight rounds, Saving Lives at Birth has funded 148 awards, saving more than 11,500 lives, and over 155,00 lives improved worldwide, with the potential to save 150,000 lives by 2030.

Advancement of Agency Mission: NA

Plan for Upcoming Two Fiscal Years: N/A

B.12.24.   Senegal Crop Storage Finance Challenge Project[249]

Sponsoring Agency and Office: Washington

Authority: Unknown

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[248] The website for Saving Lives at Birth is accessible at https://savinglivesatbirth.net/.
[249] The website for Senegal Crop Storage Finance Challenge Project is accessible at https://agresults.org/projects/senegal-storage-finance.

Competition Summary: The AgResults Senegal Crop Storage Finance Challenge Project is a five-year $6.8 million prize competition that aims to drive adoption of Warehouse Receipts Systems (WRS) in Senegal. By encouraging warehouse owners and smallholder producer groups to upgrade existing warehouses and develop collateral-based storage finance schemes, the project hopes to tackle the dual barriers of unsuitable storage infrastructure and limited financing options for vulnerable populations. By using a WRS model, smallholder farmers will benefit from higher prices, increased liquidity, and improved resilience to external shocks. Connexus serves as the Project Manager.

Advancement of Agency Mission: Increasing producer access to quality storage has the potential to reduce post-harvest losses, which in turn can increase incomes, improve nutrition consumption from increased availability of nutrient-dense foods, and improve climate outcomes through reduced food loss and waste.

Plan for Upcoming Two Fiscal Years: None reported

B.12.25. Small and Medium Enterprise Activity Challenge Fund[250]

Sponsoring Agency and Office: Overseas

Authority: Grants under Contract

Competition Summary: Pakistan's five million Small and Medium Enterprises (SMEs) employ more than 21 million people, constituting about 80% of the nonagricultural labor force. Revenue from SMEs comprises 40% of the country's gross domestic product (GDP). As such, SMEs have immense potential to generate economic growth, raise living standards, and engage people in productive and rewarding work. Before the launch of the Small and Medium Enterprise Activity Challenge Fund, promising SMEs wanted to introduce innovations and launch growth expansion plans but needed an incentive to take the financial risk. SMEs needed investment and mentorship to realize production efficiencies, improve financial management, upgrade technologies, and scale operations. SMEs needed resources to procure improved infrastructure and technology to reduce production costs, increase efficiencies and scale, enhance quality, and create skilled jobs. Lack of digitalization constrained SMEs' ability to use technology to increase sales and create jobs. Many SMEs hesitated to embrace ICT due to inexperience or the perceived or real costs involved. SMEs needed investment in software solutions, e-commerce platforms to support online payments, and digital marketing services, as well as training to use these tools. During SMEA's implementation, restrictions on movement due to the COVID-19 pandemic created an even greater need for digital tools and training to market and sell products directly to consumers, especially for women's businesses.

Advancement of Agency Mission: The United States Agency for International Development (USAID) launched the Small and Medium Enterprise Activity (SMEA) in December 2016 to contribute to USAID/Pakistan's Development Objective to increase private sector-led inclusive economic growth by improving the business enabling environment (BEE) and increasing employment opportunities in Pakistan. SMEA supported this objective by improving the competitiveness of Pakistani SMEs in six target sectors: agribusiness, information and communications technology (ICT), textiles, hospitality, logistics and packaging, and light engineering, and for women's businesses in all SME sectors.

Plan for Upcoming Two Fiscal Years: In FY23, the USAID/Pakistan Mission will issue competitive grants under a new initiative called Investment Promotion Fund. The Fund is also grants under contract

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[250] There was no website provided for Small and Medium Enterprise Activity Challenge Fund.

program under the Investment Promotion Activity (IPA). IPA is aiming to promote Foreign Direct Investment (FDI) in Pakistan and promote U.S. Pakistan bilateral trade. The Fund will have three types of grants including FDI grants, U.S. Pakistan trade grants, and tech-transfer grants.

B.12.26. Tanzania Dairy Productivity Challenge Project[251]

Sponsoring Agency and Office: Washington

Authority: Unknown

Competition Summary: The AgResults Tanzania Dairy Productivity Challenge Project is a four-year, US$4.9 million prize competition that aims to increase dairy productivity by encouraging private sector input suppliers to deliver livestock-related inputs to smallholder farmers in the dairy sector. By providing a prize for each bundle of high-quality inputs delivered, the competitions will increase animal productivity, boost smallholder farmers' incomes, and strengthen value chain relationships between dairy producers and the formal dairy sector. Land O'Lakes Venture37 serves as the Project Manager.

Advancement of Agency Mission: Higher-yielding cattle breeds and improved livestock management practices have the potential to increase small producer livelihoods and consumer nutrition, thus contributing to USAID and the Feed the Future Initiative's goals of increased food security.

Plan for Upcoming Two Fiscal Years: None reported

B.12.27. USAID Nepal Resilience in Education[252]

Sponsoring Agency and Office: Overseas

Authority: Unknown

Competition Summary: USAID has been supporting the Government of Nepal (GON) to increase the resiliency of the education system to respond to crises and ensure students' access to safe learning spaces. For example, after the disastrous Gorkha earthquake in 2015, USAID helped build Temporary Learning Centers (temporary bamboo structures) and Transitional Learning Structures (semi-permanent steel structures) benefitting over 300,000 students. USAID also responded to the recent COVID-19 pandemic, which disrupted schooling of millions of children in Nepal for almost two years. Finally, there are other kinds of natural disasters, such as flooding, landslides, extreme heat and cold weather, which also result in school closures in Nepal. To address possible challenges like those mentioned above, USAID is designing USAID Resilience in Education to support the preparedness for and assurance of continuous learning for students during potential emergencies. This activity will support the Ministry of Education, Science and Technology (MOEST) in the roll out of their Comprehensive School Safety Plan, while also seeking innovative new solutions for increasing the preparedness of schools and municipalities to ensure continuity of schooling and prevent learning loss in the case of shocks. To meet these objectives, this activity may include a challenge competition to generate innovative approaches from interested local organizations and stakeholders from private, government, or non-governmental organizations. USAID is striving to shift more leadership, ownership,

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[251] The website for Tanzania Dairy Productivity Challenge Project is accessible at https://agresults.org/projects/tanzania-dairy.

[252] There was no website provided for USAID Nepal Resilience in Education.

decision-making, and implementation to the local people and institutions, thus USAID strongly desires partnering with local partners as prime recipients of this award.

Advancement of Agency Mission: n/a

Plan for Upcoming Two Fiscal Years: We have a potential challenge fund that is still in the design stage. Additional details are procurement sensitive.

B.12.28. UnrestrICTed Challenge[253]

Sponsoring Agency and Office: Washington

Authority: Foreign Assistance Act of 1961, as amended

Competition Summary: More than 93 million children globally have a disability. Of those children with disabilities who reside in countries with high poverty levels, at least 90 percent do not attend school. A lack of suitable transportation and infrastructure, inadequate teacher training, insufficient learning support, and a dearth of quality learning resources prevent children with disabilities from attending or fully participating in school, leaving them further behind. The COVID-19 pandemic exacerbated these challenges and deepened the need for quality information and information communication technology solutions (ICT) to support learning for all children. All Children Reading: A Grand Challenge for Development (ACR GCD) seeks to scale ICT for education solutions that will ensure children with disabilities benefit from language, literacy, and learning support grounded in Universal Design for Learning (UDL) at home and at school. The three focus goals of the UnrestrICTed Challenge are: ensuring children have access to and engage with UDL-grounded ICT solutions to develop language and literacy skills; helping prepare teachers to nurture language and literacy skills of children with disabilities through UDL principles and technologies; and increasing parent and communities' understanding and access to tools to support the language and literacy skills development of children with disabilities.

Advancement of Agency Mission: ACR GCD has partnered with School-to-School International to conduct external evaluations of all awards. All evaluation reports will be widely disseminated to contribute to partner and agency research and learning agendas.

Plan for Upcoming Two Fiscal Years: The prize competition will be completed on September 30, 2023.

B.12.29. Vietnam Emissions Reduction Challenge Project[254]

Sponsoring Agency and Office: Washington

Authority: Unknown

Competition Summary: The AgResults Vietnam Greenhouse Gas (GHG) Emissions Reduction Challenge Project was a four-year, US$8 million prize competition that aimed to develop, test, and scale up innovative technologies, tools, and approaches to increase yields and reduce GHG emissions in rice production. The project planned to lower GHG emissions, protect the environment, and ultimately reduce poverty among smallholder farmers in the region. Focusing on the Thai Binh province in the Red

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[253] The website for UnrestrICTed Challenge is accessible at https://allchildrenreading.org/competition/unrestricted-challenge/.
[254] The website for Vietnam Emissions Reduction Challenge Project is accessible at https://agresults.org/projects/vietnam.

River Delta, the project used results-based prize incentives to attract a diverse pool of private sector actors and was conducted in two phases. SNV Vietnam served as the Project Manager.

Advancement of Agency Mission: Reduction of risks from climatic shocks can help improve small producer incomes and livelihoods, as well as overall food security. This contributes to Agency priorities including those within the USAID Climate Strategy and the Feed the Future Initiative.

Plan for Upcoming Two Fiscal Years: None reported

B.12.30. Water and Energy for Food Grand Challenge[255]

Sponsoring Agency and Office: Washington

Authority: Gift Agreement Authority

Competition Summary: USAID (~$10 million), Germany, the Netherlands, Norway, Sweden, and the European Union, are partners in the Water and Energy for Food Grand Challenge (WE4F; $85 million). The total value of the Grand Challenge is $8 5 million, and USAID contributed nearly $10 million to this effort. WE4F supports more than 13 5 local small and medium-sized enterprises (SMEs) and helps farmers in Africa and Asia get access to climate-smart innovations.

Advancement of Agency Mission: WE4F is a second-generation Grand Challenge for Development that capitalizes on the learnings from Powering Agriculture: An Energy Grand Challenge for Development (PAEGC) and Securing Water for Food (SWFF). The program aims to address the above-described trends and challenges. The WE4F Southern and Central Africa Regional Innovation Hub aims to expand the scale of innovations that impact the energy-food, water-food, or energy-water-food nexus to increase the sustainability of agricultural food value chains, improve energy and water efficiency, as well as to improve climate resilient agriculture and sustainable management of natural resources and biodiversity in the twelve target countries across Southern and Central Africa, with a particular focus on the poor, women, and other Base of Pyramid (BO P) beneficiaries like smallholder farmers.

Plan for Upcoming Two Fiscal Years: N/A

B.12.31. Women in Cybersecurity[256]

Sponsoring Agency and Office: Overseas

Authority: Unknown

Competition Summary: In 2023, USAID's Regional Development Mission for Asia (RDMA) will launch the Women in Cyber Competition to promote more female participation in the cybersecurity workforce in five countries in Asia: Thailand, Cambodia, Lao PDR, Indonesia and Mongolia. It is expected to be a multi-country jam session co-organized by USAID/RDMA and the International Telecommunications Union's (ITU's) regional office for Asia and the Pacific in partnership with DAI and Amazon Web Services (AWS). The participating teams will join a pre-hackathon boot camp and then compete in teams of 3-5 people to solve cybersecurity threats during the jam sessions. .

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[255] The website for Water and Energy for Food Grand Challenge is accessible at www.we4f.org.
[256] There was no website provided for Women in Cybersecurity.

Advancement of Agency Mission: It will be used to promote more gender equity in the cybersecurity industry by providing an opportunity to learn new skills, network with other people in the industry, and potentially get new job opportunities. .

Plan for Upcoming Two Fiscal Years: USAID's RDMA will launch in FY2023 the Women in Cybersecurity Competition . The overall objective of this competition is to promote more women entering the cybersecurity workforce in five countries in Asia: Thailand, Cambodia, Lao PDR, Indonesia, and Mongolia. It is expected to be a multi-country hackathon co-organized by USAID/RDMA and the ITU's regional office for Asia and the Pacific in partnership with DAI and AWS . Participation will be open to teams of women in the selected countries. Teams will join a pre-jam boot camp and then compete in the jam sessions to practice and learn how to address cybersecurity threats .

B.12.32. WomenConnect Challenge[257]

Sponsoring Agency and Office: Washington

Authority: Foreign Assistance Act

Competition Summary: The WomenConnect Challenge is a global call for solutions to improve women's participation in everyday life by meaningfully changing the ways women access and use technology. While most of the world is becoming increasingly connected, the gender gap in mobile internet use in some countries is over 51 percent. Advancing women's digital connectivity is a key component to ensuring women's economic empowerment. To date, USAID has 16 WomenConnect Challenge grantees working to address barriers limiting women's access to technology and to connect nearly 6 million women in 16 countries. WomenConnect Round One, awarded in 2018, awarded nine grants and WomenConnect Round Two, awarded three in 2019.

Advancement of Agency Mission: The effective practices derived from the three global rounds of the WomenConnect Challenge have been adapted and applied to the Microsoft Airband Digital Inclusion Partnership and the USAID/Reliance WomenConnect Challenge in India.

Plan for Upcoming Two Fiscal Years: None reported

B.13. United States Department of Education

B.13.1. Automated Scoring Challenge[258]

Sponsoring Agency and Office: Institute of Education Sciences, National Center for Education Statistics

Authority: Education Sciences Reform Act of 2002, as amended.

Competition Summary: Through the Automated Scoring Challenge, the National Center for Education Statistics invited submissions of automated scoring models to score constructed response items for the National Assessment of Educational Progress (NAEP) reading assessment. Submissions were required to demonstrate interpretability of models, provide score predictions using these models, analyze models for potential bias based on student demographic characteristics, and provide cost information for putting an automated scoring system into operational use.

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[257] The website for WomenConnect Challenge is accessible at https://www.womenconnectchallenge.org/.
[258] The website for the Automated Scoring Challenge is accessible at
https://www.challenge.gov/?challenge=naep-automated-scoring-challenge.

Advancement of Agency Mission: The purpose of the challenge is to help NAEP determine the existing capabilities, accuracy metrics, the underlying validity evidence of assigned scores, and costs and efficiencies of using automated scoring with the NAEP reading assessment items.

Plan for Upcoming Two Fiscal Years: None reported

B.13.2. CTE Mission: CubeSAT[259]

Sponsoring Agency and Office: Office of Career, Technical, and Adult Education

Authority: FAR Procurement Authority

Competition Summary: CTE Mission: CubeSat was a national challenge to build technical skills for careers in space and beyond. The U.S. Department of Education invited high schools to bring space missions to students by designing and building CubeSat prototypes — in the classroom or at home during the pandemic. Any public school that is eligible to receive funding under the Carl D. Perkins Act of 2006, as amended by the Strengthening Career and Technical Education for the 21st Century Act (Perkins V), was invited to participate in the multiphase challenge. Career and Technical Education (CTE) plays an important role in developing a more competitive workforce. Technology skills are critical for success in many careers; education providers must adapt and create opportunities for applied technical learning to prepare students for 21st-century work.

Advancement of Agency Mission: The CTE Mission: CubeSAT responded to the projected need and aligned with the Department's FY 2014-2018 Strategic Goals to improve the elementary and secondary education system's ability to consistently deliver excellent instruction aligned with rigorous academic standards while also providing effective support services to close achievement and opportunity gaps, and ensure all students graduate high school college- and career-ready; and enhance the education system's ability to continuously improve through better and more widespread use of data, research and evaluation, evidence, transparency, innovation, and technology. In addition, the Challenge supported the Office of Career, Technical, and Adult Education's (OCTAE) goal to ensure that all youth and adults are ready for, have access to, and complete college and career pathways.

Plan for Upcoming Two Fiscal Years: There are no future activities planned for this competition. OCTAE will continue to assess and identify the opportunities to leverage challenges and prize competitions to provide students with contextualized skill-building experiences that increase access to and expand the capacity of career and technical education (CTE).

B.13.3. Future Finder Challenge[260]

Sponsoring Agency and Office: Office of Career, Technical, and Adult Education

Authority: Workforce Innovation and Opportunity Act (WIOA)/Adult Education and Family Literacy Act (AEFLA), Title II of Public Law 113-128

Competition Summary: The Future Finder Challenge invited innovators — including strategists, developers, user-centered designers, and educators — to submit prototypes and accompanying proposals for digital tools that will improve the career navigation experience for adult learners.

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[259] The website for CTE Mission: CubeSAT is accessible at https://www.ctemissioncubesat.com/.
[260] The website for Future Finder Challenge is accessible at https://www.challenge.gov/?challenge=future-finder-challenge.

Advancement of Agency Mission: The Future Finders Challenge advances the Secretary of Education's Raise the Bar Initiative by accelerating the development of digital career navigation tools and services that are essential for supporting adult learners in succeeding in career pathways. The Challenge also supports several of the pillars of the Department of Education's FY 2022-2026 Strategic Plan including Strategic Objective 1.4, which seeks to enhance youths' and adults' engagement in learning; and Strategic Objective 4.3, which commits the agency to expanding equitable access to secondary and postsecondary programs.

Plan for Upcoming Two Fiscal Years: In FY 2024, ED will provide technical assistance to the Future Finder Challenge winner and runner-up to scale their career navigation solutions in the adult education ecosystem. There are no activities planned for FY 2025.

B.13.4. Rethink Adult Education Challenge[261]

Sponsoring Agency and Office: Office of Career, Technical, and Adult Education

Authority: Workforce Innovation and Opportunity Act (WIOA)/Adult Education and Family Literacy Act (AEFLA), Title II of Public Law 113-128

Competition Summary: The Rethink Adult Ed Challenge invited Adult Education and Family Literacy Act (AEFLA)-funded adult education providers to design innovative and high-quality pre-apprenticeship programs in any industry, anywhere in the United States. The purpose of the challenge was to design adult education programs that better prepare learners for apprenticeships and beyond.

Advancement of Agency Mission: Since the grand prize, first runner up, and three runners up were announced in September 2021, winners have participated in several webinars with the adult education community. OCTAE senior leadership visited the grand prize winner. The contract team developed an online course with resources and guidance around developing adult pre-apprenticeships.

Plan for Upcoming Two Fiscal Years: The Division of Adult Education and Literacy (DAEL) in OCTAE launched the Future Finder Challenge in FY22.

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[261] The website for Rethink Adult Education Challenge is accessible at https://www.challenge.gov/?challenge=rethink-adult-ed-challenge.

Summary of Agency Crowdsourcing and Citizen Science: Fiscal Years 2021–2022

Introduction to Crowdsourcing and Citizen Science (CCS)

As part of the American Innovation and Competitiveness Act of 2017, Congress passed the Crowdsourcing and Citizen Science Act (CCS Act; 15 U.S.C. § 3724),[262] which grants Federal science agencies the direct, explicit authority to use CCS to stimulate and facilitate broader public participation in the advancement of Federal agency missions. The CCS Act defines citizen science as "a form of open collaboration in which individuals or organizations participate voluntarily in the scientific process in various ways, including: (A) enabling the formulation of research questions; (B) creating and refining project design; (C) conducting scientific experiments; (D) collecting and analyzing data; (E) interpreting the results of data; (F) developing technologies and applications; (G) making discoveries; and (H) solving problems." It defines crowdsourcing as "a method to obtain needed services, ideas, or content by soliciting voluntary contributions from a group of individuals or organizations, especially from an online community." Crowdsourcing engages participants in a wide range of activities and topics from digitizing archives to analyzing satellite images; citizen science is a form of crowdsourcing that allows participants to become involved in the scientific process through data collection, logistical support, and other direct contributions to research. The Federal Government supports them jointly because of their many shared elements, including mechanisms for organizing and engaging both online and on the ground communities. While these practices were codified for Federal agencies by the CCS Act only recently, the Federal Government has a long history of engaging citizens in the scientific process. For example, Thomas Jefferson collected and shared weather observations and planned to establish a network of weather observers by providing a thermometer to one dependable deputy to collect twice-daily observations of temperature and wind direction in each county in Virginia. The Organic Act of 1890 created what is now the National Weather Service's Cooperative Observer Program,[263] which supports thousands of volunteers in the collection of observational meteorological data. The use of volunteer reports and observations by professionals continues to have an impact on research carried out by Federal agencies to advance their missions. For example, volunteer water quality monitoring has shaped the EPA's understanding of the environment, and reports from the public have improved the U.S. Geological Survey's (USGS's) detection and analysis of earthquakes. In response to increasing public interest in recent years, Federal agencies have sought to facilitate community-based participation in their missions by preserving and improving access to scientific collections, data, and other research products. At the same time, technological advances have made it easier for both researchers and the public to gather and contribute valuable data and observations. With the dropping cost of sensors and greater access to the internet and smartphones, the collection and reporting of field-based measurements by both research specialists and citizen scientists has become increasingly streamlined. The past decade has also seen the emergence of online projects that involve participants in data and image analysis. Such projects offer new pathways for the public to participate in scientific research and can attract individuals outside the reach of more traditional models of scientific engagement. These trends help make CCS more efficient as a means for Federal agencies to carry out their missions and engage the public.

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[262] More information on the CCS Act can be found at https://www.govinfo.gov/content/pkg/USCODE-2016-title15/pdf/USCODE-2016-title15-chap63-sec3724.pdf.

[263] More information about the Cooperative Observer Program can be found at https://www.weather.gov/coop/.

Federal Crowdsourcing and Citizen Science (FedCCS) Community of Practice

As implementation of CCS activities entered a period of rapid growth over the past decade, a nucleus of Federal researchers and practitioners came together to share how to employ these methods effectively in the Federal government. As early as 2012, Federal employees from various agencies began meeting as an informal discussion group, which led to the establishment in 2014 of the Federal Crowdsourcing and Citizen Science (FedCCS) Community of Practice.[264] These efforts are amplified by the work of the Crowdsourcing and Citizen Science Agency Coordinators[265], a group of Federal employees designated by their agency leaders as requested by the 2015 OSTP Memo to be responsible for implementing tasks to advance CCS. FedCCS works within and across Federal agencies to support Federal agencies in engaging the public directly and collaboratively as partners to enhance agencies' diverse missions.[266] The FedCCS Community Listserv has grown rapidly from just 50 members in 2015 to 456 members representing over 90 Federal agencies with 100 members joining between 2021 to 2022 and a total of 722 community posts as of October 2023.

Working together, the FedCCS Community increases efficiency, efficacy, and innovation across the Federal Government by sharing resources and expertise, methods and strategies, and identifying shared opportunities and needs. CitizenScience.gov is the Federal Government's central hub for CCS efforts including the following essential resources:

- **The Federal Crowdsourcing and Citizen Science Catalog.** A vetted catalog of 503 federally-supported projects as of October 2023 to increase awareness, improve cross-agency collaboration, and reveal opportunities for new high-impact projects.
- **The Federal Crowdsourcing and Citizen Science Toolkit.** A comprehensive toolkit to assist Federal CCS practitioners by providing how-to process steps, case studies, a resource library, and legal and policy resources to aid Federal agencies in implementing and managing projects.
- **The Federal Crowdsourcing and Citizen Science Community.** A community resource to find information about the FedCCS Community of Practice and the list of current CCS Agency Coordinators to support Federal practitioners interested in sharing skills, resources, and experiences to advance public participation across the government.

This centralized online portal opens opportunities for the Federal Government to pursue and strengthen interagency partnerships as well as to collaborate with industry, academia, and other organizations on CCS initiatives. It also increases the ability of Federal practitioners to access resources for project development, gain top-level approval and support, and share lessons with fellow practitioners. By bringing together relevant resources and people in one place, CitizenScience.gov helps improve the FedCCS's impact.

Crowdsourcing and Citizen Science Act

The CCS Act grants Federal science agencies the direct, explicit authority to use crowdsourcing and citizen science. This authority supports efforts at the agency level to change perceptions about the

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[264] More information about the FedCCS Community can be found at https://www.citizenscience.gov/about/community-of-practice

[265] More information about the current Crowdsourcing and Citizen Science Agency Coordinators can be found at https://www.citizenscience.gov/agency-community

[266] The 2015 OSTP Memo can be found at https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/holdren_citizen_science_memo_092915_0.pdf.

validity of CCS contributions as well as create infrastructure to support implementation of these participatory techniques. As momentum increases, agencies such as NSF have funded work on the science of citizen science focused on identifying effective approaches and developing empirically supported best practices. The FedCCS Community continues to help agencies overcome concerns that might hinder implementation due to uncertainties around data quality, privacy, liability, and/or cybersecurity by engaging FedCCS members to work together to address policy challenges for the community. For example, many CCS projects involve a Federal agency collecting information directly from the public, a process that is regulated by the Paperwork Reduction Act (PRA).[267] The PRA requires agencies to develop an Information Collection Request (ICR) to obtain OMB approval. This process demands significant time and effort from multiple agency employees that can slow or prevent projects from getting started. However, agencies are finding ways to address this requirement while collecting data in a timely fashion. For example, EPA developed a generic ICR that covers CCS requests within the agency, dramatically shortening the time required to get projects approved to start collecting data from the public. This approach has been shared with the FedCCS Community and has been replicated by NASA. As described in the CCS Act, unique benefits of CCS projects include "accelerating scientific research, increasing cost effectiveness to maximize the return on taxpayer dollars, addressing societal needs, providing hands-on learning in science, technology, engineering, and math (STEM), and connecting members of the public directly to Federal agency missions and to each other." CCS activities expand how government engages with the Nation, moving beyond working only with established entities (e.g., universities, private firms, non-governmental organizations) through contracts and grants to a collaborative approach involving broad public participation. Federal projects that use CCS do not solely benefit the U.S. Government; they also have positive impacts on the citizens who participate in them:

Enhancing scientific research and monitoring. There are multiple paths by which CCS activities support scientific research and monitoring. In certain applications, volunteers are able to collect observations over geographic areas and/or time periods that would be impractical or impossible for Federal agencies, given personnel and resource constraints. In addition, volunteers can provide unique perspectives and local expertise for interpreting data.

Providing hands-on STEM learning and increasing STEM literacy. CCS can help educate, engage, and empower students, educators, and the broader American public by applying their curiosity and contributing their talents to a wide range of real-world problems. Students have the opportunity to acquire lifelong enthusiasm for science, along with valuable skills in STEM. For students, working on real-world problems can make classroom learning experiences more engaging. For adults, working on CCS projects can help advance their knowledge and skills while contributing to a larger scientific enterprise. The 2018 study from the National Academies of Sciences, Engineering, and Medicine (NASEM) found that "citizen science supports learning outcomes related to scientific practices, content, identity, agency, data, and reasoning."[268]

Addressing societal needs. CCS can help address societal needs and Federal agency goals, ranging from enhancing the accuracy of prediction markets to tagging and transcribing national archive records. The ability to reach populations that may not previously have been engaged in scientific enterprises allows an influx of new ideas and insights. CCS can also provide unique exposure to government initiatives and

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[267] 44 U.S.C. 3501 et seq.

[268] Learning Through Citizen Science: Enhancing Opportunities by Design is available at https://www.nap.edu/catalog/25183/learning-through-citizen-science-enhancing-opportunities-by-design.

the scientific process for the children and adults involved in those activities. The study from NASEM summarized these societal benefits: "citizen science can create opportunities for communities, especially communities who have been marginalized, neglected, or even exploited by scientists, to collaborate with scientists and the science community."

Appendix C. Crowdsourcing and Citizen Science under the American Innovation and Competitiveness Act

This Appendix provides agency-submitted summaries of crowdsourcing and citizen science activities conducted in FY19 and FY20 under the authority provided in the Crowdsourcing and Citizen Science Act.

C.1.   Department of Commerce (USDOC)

C.1.1. Urban Heat Island Mapping Campaign[269]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Crowdsourcing and Citizen Science Act

Activity Summary: Over the past six years, NOAA (Office of Education, Climate Program Office, and the National Integrated Heat Health Information System (NIHHIS)) has funded CAPA Heat Watch to support 60+ communities across the United States in mapping their urban heat islands (UHIs). Private sector company CAPA Strategies LLC, has developed a process to help cities plan and execute a volunteer-based community science field campaign that builds upon local partnerships, engages residents in a scientific study to map and understand how heat is distributed in their communities, and produces high-quality outputs that have been used in city sustainability plans, public health practices, urban forestry, research projects, and other engagement activities. These community science field campaigns are an excellent opportunity to raise awareness about the many impacts of extreme heat and the factors that may affect the uneven distribution of heat throughout a community. It is also an opportunity to teach aspiring young scientists about how scientific field campaigns are conducted, consists of volunteers learning about urban heat in a training session, attaching sensors to their vehicles, and driving pre-mapped transects through their cities to collect temperature and humidity data that is linked to GPS coordinates. The final product of the community science field campaigns is a set of high-resolution air temperature and humidity data, and a report by CAPA Strategies that provides a detailed analysis of distribution of heat in the morning, afternoon and evening. With the data report, communities are better able to work with local decision makers and organizations to implement equitable cooling solutions to provide relief for the hottest neighborhoods in their community.

Advancement of Agency Mission: Since 2017, there have been many outcomes and solutions from the urban heat island data that have advanced NOAA's mission of "understanding and predict changes in climate, weather" and to "sharing that knowledge and information with others". For example, the data from our UHI program was incorporated into the city of Houston's comprehensive resilience strategy. It was also used by the Honolulu Hawaii Chief Resilience officer to inform tree planting. Multiple King County/Seattle departments are working with communities to develop the county's first-ever Extreme Heat Mitigation Strategy to prepare the region for prolonged heat events. Additionally, city leaders in Cincinnati want to plant hundreds of new trees at schools, recreation centers and public housing projects in Cincinnati's hottest, and often poorest, neighborhoods this fall.

Justification for Using Crowdsourcing and Citizen Science: The urban heat island (UHI) effect has been studied for decades, so we know the basics of what causes it and we also know what can be done to

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[269] The website for Urban Heat Island Mapping Campaign is accessible at https://www.heat.gov/pages/mapping-campaigns.

address it. What makes the NIHHIS UHI campaign unique is that is a citizen science community project that relies on volunteers and organizers from each city or county to collect the temperature data, which leads to education about heat and health, as well as a deeper understanding of how heat is impacting their community. The mapping campaign is conducted by the residents of these neighborhoods who are collecting temperature and humidity data, learning about heat and health, and they are invested in not only seeing the results but taking actions based on those results.

C.2.   Department of Health and Human Services (HHS)

C.2.1. Epidemic Prevention Initiative[270]

Sponsoring Agency and Office: Centers for Disease Control and Prevention

Authority: Crowdsourcing and Citizen Science Act

Activity Summary: Timely interventions like vaccinations can prevent or control the adverse impacts of epidemics on human health. However, prediction of epidemics is extremely challenging. For example, the incidence of dengue – a vector-borne disease affecting approximately 100 million people per year – can increase 3-5 fold during an epidemic, yet no clear indicator of the intensity or timing of an epidemic exists until it is already underway. Influenza and other globally important diseases present similar challenges. Advances in forecasting for these diseases and others are continually occurring, yet research gaps limit forecasting model development, evaluation of forecasts, and adoption by decision-makers. The Epidemic Prediction Initiative (EPI) aims to improve the science and usability of forecasts by addressing these challenges. Since January 2016, EPI has published influenza forecasts from participating teams in real-time on CDC websites. This was the first time that infectious disease forecasts from multiple groups were published jointly in real-time, facilitating forecast comparison and evaluation by public health officials. EPI also initiated and maintains an open online repository of code and data related to epidemics. This activity aims to reduce redundancy in data cleaning, standardize data formats, and support forecasting research. Finally, EPI has been engaging in outreach efforts within CDC, among other federal government agencies, with state and international public health officials, and in the academic community to better understand how to improve forecast accuracy and how forecasts can be used in public health decision making. The collaborative approach of EPI is the basis for COVID-19 forecasting in the U.S., the largest scale real-time epidemic forecasting initiative to date.

Advancement of Agency Mission: CDC works 24/7 to protect America from health, safety and security threats. EPI's CCS activities have supported this mission by facilitating the development of multiple operational infectious disease forecasting systems for the United States. EPI has demonstrated that multiple infectious diseases can indeed be predicted, and it represents a unique network of researchers and public health officials, who work to provide real-time forecasts whose accuracy has been assessed and that public health officials can use. In addition, EPI has provided a forum to help public health officials across the country access, interpret, and communicate the results and for CDC to communicate the forecasts to the general public. Because of this work, these forecasts can now be used to more effectively plan for and prevent illnesses, hospitalizations, and deaths experienced during epidemics and pandemics.

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[270]   The   website   for   Epidemic   Prevention   Initiative   is   accessible   at https://www.cdc.gov/flu/weekly/flusight/index.html.

Justification for Using Crowdsourcing and Citizen Science: By utilizing CCS, CDC was able to receive, combine, and evaluate infectious disease forecasts in real-time from multiple teams based on a variety of data sources and methodologies. These forecasts were submitted by teams that were affiliated with a diverse set of organizations including universities and private industry, and some of the teams had never produced an infectious disease forecast before participation in the CCS. The high number of forecasts received through this approach is in contrast to the number of forecasts that would have been received if a more traditional method of outside engagement available at CDC was utilized (e.g., traditional contracts or grants). The CCS mechanism allowed CDC to establish the overall goal of accurate forecasts without specifying the forecasting methodologies and allowed CDC to evaluate forecasts for accuracy and quality.

C.3.   Department of the Agriculture (USDA)

C.3.1. Air Quality Bio-Monitoring Using Lichens on the Tahoe National Forest[271]

Sponsoring Agency and Office: Forest Service

Authority: Crowdsourcing and Citizen Science Act,Volunteers in the National Forests Act of 1972, as amended, 16 U.S.C. 558a-558d

Activity Summary: In the late 1990's and early 2000's, the Forest Inventory and Analysis (FIA) program conducted lichen community surveys at plots across California, including the Tahoe National Forest (TNF). Initially, the plots were meant to be revisited every ten years, but FIA has discontinued the lichen community surveys due to budget constraints. There has been much advancement in lichen biomonitoring since the early 2000's and it is now possible to collect target lichen species for elemental analysis in a laboratory. This citizen science project enables the continuation of the lichen plot surveys that were halted due to the aforementioned budgetary constraints. Using a relatively simple procedure, volunteers can assist trained experts in conducting the lichen community survey while also providing key lichen data that informs our understand of the local air quality. This project also aims to connect more people to public lands while highlighting the important ecological role that these indicator species play.

Advancement of Agency Mission: The lichen data will be used by the USFS Air Program to detect hotspots of nitrogen pollution and decide where to locate air quality monitors. The pertinent data has already been used in a Wilderness Character Monitoring baseline report to help assess air quality in the Granite Chief wilderness area, which is in the TNF.

Justification for Using Crowdsourcing and Citizen Science: This citizen science project enables the FS to monitor and collect data on lichen plots that were halted due to the aforementioned budgetary constraints. Having this additional capacity allows for more comprehensive data collection that can provide valuable information on air quality. The protocol for collection is also relatively simple and does not require technical expertise, which makes it a great citizen science project. Additionally, citizen science is a way to connect the public to the import ecological role that lichens play and increase a shared understanding between the public and the FS on the ecological condition of public lands.

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[271] The website for Air Quality Bio-Monitoring Using Lichens on the Tahoe National Forest is accessible at https://lichenscitisci.org/.

C.3.2. Collaborative Adaptive Rangeland Management (CARM)[272]

Sponsoring Agency and Office: Research, Education, and Economics

Authority: Crowdsourcing and Citizen Science Act

Activity Summary: The overarching goal of this study is to examine how science can be conducted in a real-world manner (i.e., at ranch-level scales with manager involvement) to evaluate the effectiveness of adaptive grazing management for both production and conservation goals. In particular, we seek to examine how grazing management can be implemented in a manner that responds to current and changing rangeland conditions, incorporates active learning, and makes decisions based on quantitative, repeatable measurements collected at multiple spatial and temporal scales. To this end, ARS scientists and university collaborators have developed an adaptive grazing management experiment being implemented at the Central Plains Experimental Range in northeastern Colorado. A Stakeholder Group of 11 persons was selected to represent ranchers, public land managers, conservation organizations and nongovernmental organizations. This Stakeholder Group met in September of 2012 and January and September of 2013 to 1) choose and prioritize outcomes desired from this experiment, 2) determine criteria and/or triggers for movement of livestock among pastures in an adaptive manner, and 3) select appropriate monitoring data requirements needed for feedback to determine if management is achieving desired outcomes. This experiment has now been implemented from 2014 to the present. The CARM experiment is part of the USDA Long-Term Agroecosystem Research (LTAR) network.

Advancement of Agency Mission: The overarching goal of this study is to examine how science can be conducted in a real-world manner (i.e., at ranch-level scales with manager involvement) to evaluate the effectiveness of adaptive grazing management for both production and conservation goals. In particular, we seek to examine how grazing management can be implemented in a manner that responds to current and changing rangeland conditions, incorporates active learning, and makes decisions based on quantitative, repeatable measurements collected at multiple spatial and temporal scales. To this end, ARS scientists and university collaborators have developed an adaptive grazing management experiment being implemented at the Central Plains Experimental Range in northeastern Colorado.

Justification for Using Crowdsourcing and Citizen Science: For multi and transdisciplinary research that is participatory.

C.3.3. Developing a Citizen Volunteer Water Quality Monitoring Program in Alabama's National Forests[273]

Sponsoring Agency and Office: Forest Service

Authority: Crowdsourcing and Citizen Science Act,Volunteers in the National Forests Act of 1972, as amended, 16 U.S.C. 558a-558d

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[272] The website for Collaborative Adaptive Rangeland Management (CARM) is accessible at https://www.ars.usda.gov/plains-area/fort-collins-co/center-for-agricultural-resources-research/rangeland-resources-systems-research/docs/range/adaptive-grazing-management/research/.

[273] The website for Developing a Citizen Volunteer Water Quality Monitoring Program in Alabama's National Forests is accessible at https://storymaps.arcgis.com/stories/cc3320c26279475194e12403b41337af.

Activity Summary: The goal of this project is to establish a network of citizen scientists in the National Forests of Alabama (NFAL) who can assist with the collection of water data in priority watersheds identified through the USDA FS Watershed Condition Framework. The project is streamlining the NFAL hydrology and aquatic ecology programs by providing workflows for water quality monitoring and data collection that support both programs. To accomplish the project's goal, NFAL established a partnership with the Alabama Water Watch (AWW) program, a statewide volunteer water monitoring program that is based at the Auburn University Water Resources Center and is also supported by the Alabama Cooperative Extension System. AWW led recruitment and training of citizen scientists who were certified to conduct water chemistry and bacteriological water tests according to AWW's EPA-approved Quality Assurance Plans. Following certification, volunteer monitors chose strategically-selected sampling sites from the priority watershed on each forest. The project provides volunteers with access to the monitoring materials required for data collection. Monitors submit their water data monthly to the AWW Database through AWW's online data portal. In turn, the data is made public through the AWW Water Data Tools on the AWW webpage and is provided to NFAL for further analysis. Because of their engagement in the project as citizen scientists, participants now have an increased sense of appreciation of the NFAL. Furthermore, they are helping accomplish two critical tasks: first, to establish a baseline of water quality observations within the priority watersheds on the NFAL that will be used to evaluate how management practices are resulting in clean water for the forests, ecosystems, and the public; and second, to develop a Watershed Restoration Action Plan (WRAP) to make better land management decisions within each forest.

Advancement of Agency Mission: The Forest Service Watershed Condition Framework (WCF) has established a process for improving the health of watersheds on national forests and grasslands. One of WCFs national priorities encourages coordination with external partners in watershed management. This priority allows for NFAL to develop a new partnership with AWW to gather chemical and bacterial monitoring data on specific streams within seven current and/or future priority watersheds across five Ranger Districts. This collaboration will help NFAL determine if we are maintaining and restoring watershed productivity and resiliency and the associated aquatic ecosystems on national forests lands.

Justification for Using Crowdsourcing and Citizen Science: Since 1992, AWW has been successfully applying and refining their model of community- and science-based water monitoring, earning them national and international recognition in the realm of citizen science. AWW staff is highly experienced in volunteer recruitment, workshop coordination and facilitation, data management, and data interpretation. These practices rigorously follow EPA-approved quality assurance plans. AWW volunteer monitors enable the collection of thousands of water quality data records each year. AWW effectively manages an easy-to-use, public, online database and provides tools for data entry, viewing, sharing, analysis, and interpretation.

C.3.4. Invasive Mosquito Project[274]

Sponsoring Agency and Office: Research, Education, and Economics

Authority: Crowdsourcing and Citizen Science Act

Activity Summary: The Invasive Mosquito Project is aimed at monitoring invasive container-inhabiting mosquito species across the United States. By doing this monitoring, we can determine where the invasive mosquito species, as well as native species, are distributed across the U.S. and define at-risk

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[274] The website for Invasive Mosquito Project is accessible at http://www.citizenscience.us/imp/.

human and animal populations based on this distribution. This citizen science project provides students, teachers, and anyone interested the opportunity to collect real data and contribute to a national mosquito species distribution study. This project not only gives individuals an opportunity to explore and collect around their house, but also raises awareness of diseases that can be transmitted by mosquitoes, and how they can make an effort to protect themselves, communities, and pets from illness.

Advancement of Agency Mission: The Invasive Mosquito Project is aimed at monitoring invasive container-inhabiting mosquito species across the United States. By doing this monitoring, we can determine where the invasive mosquito species, as well as native species, are distributed across the U.S. and define at-risk human and animal populations based on this distribution. This citizen science project provides students, teachers, and anyone interested the opportunity to collect real data and contribute to a national mosquito species distribution study. This project not only gives individuals an opportunity to explore and collect around their house, but also raises awareness of diseases that can be transmitted by mosquitoes, and how they can make an effort to protect themselves, communities, and pets from illness.

Justification for Using Crowdsourcing and Citizen Science: To engage with the public, gather data, and work together to solve a problem. Putting "Public" back into public health.

C.3.5. Land Management and Monitoring Apps Development[275]

Sponsoring Agency and Office: Research, Education, and Economics

Authority: Crowdsourcing and Citizen Science Act

Activity Summary: The Agricultural Research Service will work together with partners including the Bureau of Land Management (BLM) National Operations Center (NOC), U.S. Agency for International Development (USAID), Natural Resources Conservation Service (NRCS) and other federal and non-federal partners to enhance access to landscape information. The use of the tool informs and supports inventory assessment and monitoring processes within the context of land potential. Specifically, this will be achieved through the continued development of mobile and web applications designed to facilitate collaborative monitoring efforts through common data collection platforms, standardized methods, and streamlined data sharing. Data collected and shared through these apps would increase knowledge of land potential, current conditions and management responses to improve adaptive land management throughout the United States and globally.

Advancement of Agency Mission: As a co-benefit of users collecting data using the app, the agency will gain access to soil profile characterizations that will be used by NRCS to improve soil maps nationally. Furthermore, the vegetation data will be used by ARS to improve satellite-based rangeland cover prediction tools that are used by land management agencies and the general public.

Justification for Using Crowdsourcing and Citizen Science: CCS was chosen because engaging the public in collecting and accessing scientific knowledge and information is an effective tool for encouraging the use of science in decision-making.

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[275] The website for Land Management and Monitoring Apps Development is accessible at https://landpotential.org/.

C.3.6. Leveraging Citizen Science to Map Lamprey Distributions in Oregon Using eDNA Methods[276]

Sponsoring Agency and Office: Forest Service

Authority: Crowdsourcing and Citizen Science Act,Volunteers in the National Forests Act of 1972, as amended, 16 U.S.C. 558a-558d

Activity Summary: There are at least two native species of lamprey living in Oregon's coastal watersheds, yet very little information is known about their distributions and population size. Obtaining distribution and population-status information can be labor intensive (e.g., electrofishing, redd counts) and distinguishing adult Brook Lamprey and Pacific Lamprey ammocetes requires specialized expertise. These constraints, paired with a lack of prior management interest in lamprey population status, has meant that lamprey data collection is often ancillary to other studies (e.g., salmonids). Environmental DNA (eDNA) is one technique that can help us obtain species-specific lamprey data to aid in the development of accurate fish distribution maps. eDNA techniques also lend themselves to the use of volunteer networks to collect the necessary samples, since volunteers do not need to be experts in identification of juvenile lamprey. This project aims to develop a network of citizen scientists and test several techniques for obtaining eDNA samples in targeted areas within the Coos watershed.

Advancement of Agency Mission: Quality control of data sampling leads to highly repeatable and empirical results that identify the presence or absence of difficult-to-find native lamprey. Detailed and accurate information that can be collected throughout river networks contributes to the efficient and accurate operations of forest staff conducting restoration and conservation projects in watersheds. Updated native lamprey distribution maps will allow for better management to protect occupied habitats. Because lamprey use fine-grained sandy substrate, they may be found in places that could be targeted for restoration intended to enhance habitat for salmonids. This study could reveal ways that restoration for salmonids could also benefit lamprey.

Justification for Using Crowdsourcing and Citizen Science: Citizen science is a natural avenue for the collection of eDNA samples. While attention to detail to avoid sample contamination is critical, simple methods for sampling can easily be shared with non-technical citizen scientists. Community partners will help the science team formulate questions and determine best locations and practices for sampling. Citizen science volunteers were included in the initial testing of methods and provided feedback to improve the program.

C.3.7. Monitoring American Pika Response to Climate Change in Colorado[277]

Sponsoring Agency and Office: Forest Service

Authority: Crowdsourcing and Citizen Science Act,Volunteers in the National Forests Act of 1972, as amended, 16 U.S.C. 558a-558d

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[276] The website for Leveraging Citizen Science to Map Lamprey Distributions in Oregon Using eDNA Methods is accessible at https://sloughvolunteers.wixsite.com/website/post/special-cohort-of-volunteers-begin-the-search-for-edna | https://www.citizenscience.gov/catalog/535/# | https://www.fs.usda.gov/inside-fs/delivering-mission/apply/citizen-scientists-help-conduct-lamprey-research.

[277] The website for Monitoring American Pika Response to Climate Change in Colorado is accessible at https://pikapartners.org/.

Activity Summary: The American Pika is a charismatic mammal that is sensitive to climate-driven variation in temperature, snowpack, and vegetation composition. Extirpation of pika populations has been linked to climate change in the Great Basin, Southern Utah and California. The species, however, may be more resilient to climate change in high-elevation habitats in Colorado. Nevertheless, recent research predicts that pikas may be extirpated from Rocky Mountain National Park (RMNP) by 2100 under some climate change scenarios. There is a pressing need to assess the species' vulnerability to climate change across Colorado. The White River National Forest (WRNF) and the Colorado Pika Project (CPP) are currently engaging citizen scientists in field surveys to determine the status of pika populations as an indicator of alpine ecosystem integrity. They are collecting data to determine pika distribution, improve understanding of environmental variables that limit pika distribution, and predict and track the species' response to climate change.

Advancement of Agency Mission: The American pika became a White River National Forest (WRNF) focal species with the implementation of the 2012 Planning Rule for land management plans. We are currently determining the status of American pika populations as an indicator of alpine ecosystem integrity (per the 2016 WRNF Monitoring Plan). Pika occupancy surveys are needed to determine current pika distribution and the most important biotic and abiotic factors limiting distribution patterns in the WRNF. Additional presence data from opportunistic surveys is needed to improve landscape-scale characterization of American pika distribution across the WRNF to inform statewide management. This project will add an opportunistic pika survey component in the WRNF and provide guidance for other National Forests and National Parks to replicate our project. In summary, this project will provide vital data to discern the status.

Justification for Using Crowdsourcing and Citizen Science: Partnering with Colorado Pika Project (CPP) to engage volunteers in conducting pika surveys across the WRNF is enabling staff to efficiently determine pika distribution and lay the baseline for monitoring changes in alpine ecosystems and pika distributions occurring due to climate change. Citizen science is the optimal method because large-scale monitoring is needed and research shows that volunteers can effectively monitor pika occupancy. This partnership is reducing WRNF operating costs and increasing wildlife program efficiency by saving staff time and costs for planning, field surveys, and data analysis. In addition, the partnership is adding value to resource management by providing credible data to discern the status of pika in the WRNF and engaging local volunteers to identify habitat management opportunities for this focal species.

C.3.8. Multi-Resource Monitoring of Rare Communities in the Red River Gorge of the Daniel Boone National Forest[278]

Sponsoring Agency and Office: Forest Service

Authority: Crowdsourcing and Citizen Science Act, Volunteers in the National Forests Act of 1972, as amended, 16 U.S.C. 558a-558d

Activity Summary: The Red River Gorge contains significant biological and cultural resources in sandstone cliff line environments that are extremely sensitive to human impacts. One biological resource of special significance is the recently delisted, white-haired goldenrod, which is a plant species that exists nowhere else on earth. Of equal importance is an archaeological national register district, with 442 contributing sites in the Gorge. Through citizen science, these important areas can be

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[278] There was no website provided for Multi-Resource Monitoring of Rare Communities in the Red River Gorge of the Daniel Boone National Forest.

monitored more frequently and intensely than is possible with Forest Service or partner time alone. Engaging the public in data collection through this citizen science program will create opportunity for public education and a means to develop a vested interest by the community in protecting these unique resources. The goal is to develop a streamlined protocol for monitoring these biological and cultural resources that will result in quality data that is reliable enough to inform management decisions and is realistically implementable by volunteers with moderate training without negatively impacting the monitored habitat, species, or cultural resources. Ideally, a greater sense of public stewardship of the land and understanding of the challenges faced by public land management agencies will be gained. Additionally, volunteer-collected data will be used to help protect rare, non-renewable cultural resources of the Red River Gorge and generate understanding of how unmitigated recreation can degrade sensitive biological and cultural resources.

Advancement of Agency Mission: This project contributes to monitoring information about the recently delisted, endemic white-haired goldenrod so that population trends can be tracked. The project will also contribute to information about both other cliff-line species that are observed and impacts to heritage resources. Several important cliff-line sites already have fencing and signage to prevent trampling, but this project provides monitoring of those existing mitigation measures to ensure that they remain effective and identify infrastructure that requires repairs or replacement.

Justification for Using Crowdsourcing and Citizen Science: Citizen science was chosen to achieve the intended goals because volunteers enabled monitoring of these sensitive areas at a greater frequency and intensity than would be possible with FS or partner time and capacity alone. Volunteers can monitor areas that are easy to access, such as major recreation areas, freeing up time for FS employees to survey more remote locations. Citizen science also fosters a greater sense of public stewardship and a shared understanding of public land management challenges.

C.3.9. Stream Tracker: Monitoring Streamflow Intermittence through Citizen Science[279]

Sponsoring Agency and Office: Forest Service

Authority: Crowdsourcing and Citizen Science Act,Volunteers in the National Forests Act of 1972, as amended, 16 U.S.C. 558a-558d

Activity Summary: Many of the management requirements in National Forests relate to maintaining stream health. Intermittent streams that do not flow continuously make up most of the stream length in National Forests, yet these smaller streams are rarely monitored and poorly understood in terms of their annual water yield. Stream Tracker aims to improve monitoring of intermittent streams through citizen scientist observations of flow presence/absence. The goal of the project is to implement Stream Tracker as part of ongoing volunteer-based watershed monitoring in the Arapaho and Roosevelt National Forests (ARNF). The project established stream monitoring points along roads and trails on the forest where volunteers can take photos and record observations of streamflow via a paper datasheet, website, or mobile phone application. Through an adopt-a-stream model, teams of volunteers take ownership over monitoring sites to record streamflow data regularly. Ongoing engagement for Stream Tracker has been promoted through newsletters, regular social media posts, prize incentives, and an end-of-water-year party for participants. Data entered through the project portal are open access and will contribute to updated maps of streamflow conditions throughout ARNF.

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[279] The website for Stream Tracker: Monitoring Streamflow Intermittence through Citizen Science is accessible at https://www.streamtracker.org/arnf-project.

Advancement of Agency Mission: This work has greatly increased the information available for small headwater streams in the forest study area. Prior to this project, the only headwater tributaries monitored in the Cache la Poudre basin were those that are above and below water supply reservoirs. Observations of streamflow condition provide baseline data that then becomes invaluable for mapping change over time to large-scale disturbance. For example, much of the study area was burned in 2020 by the Cameron Peak and East Troublesome wildfires. The data have been used to identify streams that could be suitable for fish reintroduction and as part of a large nation-wide effort to evaluate the quality of current stream classifications in the National Hydrography Dataset.

Justification for Using Crowdsourcing and Citizen Science: Citizen science was chosen as a means to work with existing volunteer groups in the area that had established restoration and stewardship projects planned on the forest. Working with this specific group of volunteers enabled the FS and partners to understand areas of mutual benefit and share ideas about where Stream Tracker could best be implemented.

C.4. Environmental Protection Agency (EPA)

C.4.1. Air Sensor Toolbox[280]

Sponsoring Agency and Office: Office of Research and Development

Authority: Crowdsourcing and Citizen Science Act

Activity Summary: Air pollution sensors are a class of technology that are lower in cost, more portable, and generally easier to operate than regulatory-grade air quality monitors. These commercially available air sensors are widely used in the United States to understand air quality conditions. EPA's Air Sensor Toolbox provides the latest science on the performance, operation, and use of air sensors for technology developers, air quality managers, citizen scientists, and the public. The online toolbox is part of a larger EPA research and development program to advance air sensor technology, which includes performance evaluations of sensor devices and identification of best practices for effective use of sensors. The information helps the public learn more about air quality in their communities and how to use air sensors appropriately for a desired application.

Advancement of Agency Mission: The Air Sensor Toolbox supports the EPA's mission to protect human health and the environment by providing accurate information about the use of air sensor technology. The web-based toolbox communicates EPA research findings; provides up-to-date information on how to measure air pollution and its sources; and advances knowledge on newer, more cost-effective air quality measurement devices. The Air Sensor Toolbox provides support to citizen scientists who want to measure air pollution and provide data that can be used in environmental protection decisions.

Justification for Using Crowdsourcing and Citizen Science: Public involvement in measuring air pollution helps communities understand and solve air pollution problems. Air sensors continue to grow in use because the lower price point makes sensors more affordable for individuals and community groups. With growing use comes a need to support the user community with information on technical aspects of monitoring. EPA's Air Sensor Toolbox website provides information for citizen scientists that want to use air sensors to learn about air quality in their communities. The website provides a wide range of information including: data on expected sensor performance so that users can make informed

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[280] The website for Air Sensor Toolbox is accessible at https://www.epa.gov/air-sensor-toolbox.

purchasing decisions; best practice for use; tools and information on how to interpret air sensor data; findings from EPA's research program on air sensor technologies; and, access to other technical resources.

C.4.2. Best Practices Guide for Library Air Sensor Loan Programs[281]

Sponsoring Agency and Office: Office of Research and Development

Authority: Crowdsourcing and Citizen Science Act,Clean Air Act

Activity Summary: There is currently limited material available to the public on how to use lower cost air sensors in community settings. This project, still in the design phase, will create curricula and training materials that can be used by non-technical staff in a school, library or other community settings to explain how the public can use sensors to collect data about air pollution in their neighborhood. EPA will compile a Best Practices guide that draws on lessons learned from several EPA-sponsored air sensor loan programs across the U.S. that pilot and evaluate air sensor training curricula. The guide will include sensor curriculum for youth and adults and other transferable materials like startup guides, as well as a grab-and-go option for organizations starting their own air sensor loan program. A science fair event is planned that will bring together the community participants from different library loan programs to share lessons learned and user experiences.

Advancement of Agency Mission: Air sensors are an important environmental tool for the public, since many air hazards are not detectable without monitoring. The goal of this project is to expand public opportunities to contribute to EPA's mission to protect human health and the environment. An increase in equipment loan programs will increase the number of air sensors available to communities, particularly in areas that might not otherwise have access to these tools. Air sensor programs provide communities with information about the air quality in their neighborhoods, homes, places of worship, and schools. This builds awareness about air pollution and helps people learn how to manage individual exposure that can impact health and wellbeing. Expanding access to low-cost air sensors can help individuals and communities take steps to protect their health and environment.

Justification for Using Crowdsourcing and Citizen Science: CCS was an accessible way to address this issue and engage communities in increasing their environmental literacy. While a lower price point makes sensors more affordable for some individuals and community groups, there are still many libraries and people that do not have the resources to purchase their own air sensor nor realize that this is important to communities and public health. The loan pilots increase access to these tools and therefore, builds community knowledge of environmental issues that impact communities throughout the US. These pilots allow participants to be better educated about localized sources of air quality and allow participants to take appropriate actions to protect their health and their environments with support of the loan program staff.

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[281] The website for Best Practices Guide for Library Air Sensor Loan Programs is accessible at https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=CEMM&dirEntryId=355832.

C.4.3. CyanoScope: EPA Collaborative Partnership on Monitoring Harmful Algal Blooms[282]

Sponsoring Agency and Office: Region 1 - Boston

Authority: Crowdsourcing and Citizen Science Act,Clean Water Act

Activity Summary: BloomWatch and cyanoScope are two tiers of a three-tiered program to identify, monitor, and manage harmful cyanobacteria blooms. BloomWatch is the first tier of the program that utilizes an EPA approved and developed phone app, allowing the public at large to photo document the occurrence of a suspected bloom. These images are immediately uploaded to a crowdsourced public facing data dashboard while notifications of the event are sent simultaneously to preselected email lists as established by the user. This allows for individuals/organizations in charge of managing blooms to be notified immediately and appropriate action to be taken. CyanoScope is the second program tier and follows on bloomWatch by enabling the participant to collect bloom samples after taking bloomWatch images and using consistent methods for microscopically confirming cyanobacteria populations within the waterbody and identifying potentially toxic genera within the sample. This step helps verify that the bloomWatch images are indeed cyanobacteria in origin and provides notice that potentially toxin producing cyanobacteria are present.

Advancement of Agency Mission: There is a significant need for understanding the type, occurrence, and extent of harmful cyanobacteria blooms in our Nation's waterbodies and national parks while simultaneously increasing the public awareness of cyanobacteria and their potential harm to human health and the environment. The National Environmental Education Act, § 4, 20 U.S.C. § 5503 authorizes EPA to develop and support programs to increase environmental literacy. This program greatly enhances the public knowledge on cyanobacteria blooms through active participation and provides vital information on bloom occurrence and behavior in areas that the public frequents, but EPA does not have the resources to survey. OMB Memo M-15-16 encourages agencies to use approaches such as citizen science, which is a key component of this effort and formulates a strong collaborative effort between the public, EPA, and the Department of Interior.

Justification for Using Crowdsourcing and Citizen Science: With the increasing ubiquity of harmful cyanobacteria bloom occurrences, the lack of public knowledge on the risk to animal and public health from cyanobacteria, and the limited federal staff available to focus on the issue, CCS is the appropriate mechanism for an efficient collaborative effort among all stakeholders. Citizen scientists provide the observational network to cover broad geographic areas where federal and state scientists are not always present and provide a prompt reporting network to assist scientists in understanding the magnitude, frequency, and potential risk from cyanobacteria.

C.4.4. Demonstration of Air Sensor Loan Programs for Rural Communities and Living/Nature Museums[283]

Sponsoring Agency and Office: Office of Research and Development

Authority: Crowdsourcing and Citizen Science Act,Clean Air Act

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[282] The website for CyanoScope: EPA Collaborative Partnership on Monitoring Harmful Algal Blooms is accessible at https://cyanos.org/ | https://www.inaturalist.org/projects/cyanoscope.

[283] The website for Demonstration of Air Sensor Loan Programs for Rural Communities and Living/Nature Museums is accessible at https://www.epa.gov/air-sensor-toolbox/air-sensor-loan-programs#r5.

Activity Summary: This innovative project in the Midwest will help the public better understand the impacts of air pollution in smaller communities and will provide information on how people can reduce their exposures to certain types of pollution, such as particulate matter. This Air Sensor Loan Project has been demonstrating educational and equipment loan programs in a small number of remote Midwestern libraries (Evansville-Vanderburgh, IN; L'Anse, MI; and, Superior District libraries, MI) and educational/library programs found at living museums/nature centers (The Morton Arboretum, Lisle, IL). The project had four components, including: (1) virtual training for library & educational program staff on basic information about air pollution, health impacts, lower-cost air monitoring sensors vs. more expensive regulatory air monitoring equipment; (2) introducing/developing activities/resources focused on air pollution and measurements with lower cost air sensors specifically designed for community members in remote locations; (3) offering lower cost air sensors that can be used in loan and educational programs; and, (4) understanding the successes and challenges associated with loan programs which can be shared with others interested in starting a loan program.

Advancement of Agency Mission: This rural air sensor loan project advances EPA's mission to protect human health and the environment by educating the public about air pollution and helping people take actions to reduce their exposures and protect their health. The project provides smaller, rural community libraries and similar organizations (i.e., living museums) an innovative hands-on way to educate community members about air pollution. With the support of trained library and resource staff, the public can use these monitoring technologies to learn about local air quality.

Justification for Using Crowdsourcing and Citizen Science: Through working with many rural/remote communities across the Midwest, the participating library pilots saw a lack of environmental literacy in many of the communities they serve. The librarians realized their communities did not have access to localized air quality information since state/tribal-operated regulatory monitors are quite far apart in these locations. Crowdsourcing and citizen science was an accessible way to address this issue and engage communities in increasing their environmental literacy. While a lower price point makes sensors more affordable for some individuals and community groups, there are still many libraries and people that do not have the resources to purchase their own air sensor nor realize that this is important to communities where general air quality may not be a concern. The loan pilots increase access to these tools and builds community knowledge of environmental issues.

C.4.5. Demonstration of a Tribal Air Sensor Loan Program[284]

Sponsoring Agency and Office: Office of Research and Development

Authority: Crowdsourcing and Citizen Science Act,Clean Air Act

Activity Summary: To determine ambient air quality conditions around the U.S., criteria air pollutants are measured at a limited number of sites using expensive, regulatory-grade instruments. New, lower-cost air sensors have become available to the public who are using the devices to learn more about air quality in their communities. EPA Region 10's community-based air sensor loan program was established in tribal communities to enhance equal access to air sensors and provide public education about air quality, air sensors, and health implications. This air sensor loan project expands ongoing EPA efforts to support community monitoring of air pollution by adding unique demographic partners, utilizing a different type of air sensor, and supporting different loan program structures. The target

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[284] The website for Demonstration of a Tribal Air Sensor Loan Program is accessible at https://www.epa.gov/air-sensor-toolbox/air-sensor-loan-programs.

audience is tribal and surrounding communities that experience poor air quality caused by wildfires, outdoor burning, and residential wood heaters, which may result in adverse health impacts. These impacts can be mitigated through increased public awareness and understanding of air quality. The resources developed through this project resources engage and empower the public to develop knowledge in air quality science, gain an understanding of particulate matter pollution and associated health risks, and learn about data interpretation. While these sensors are not suitable for regulatory decision making, these sensors allow citizen scientists to contribute to localized, community-based air quality assessments. This project increases community capacity and expertise in use of air quality sensors through a partnership between EPA Region 10, tribal partners, and the local communities.

Advancement of Agency Mission: The project supports EPA's mission to protect human health and the environment by investigating air pollution, educating the public, advancing knowledge of newer and more cost-effective measurement devices, and incorporating of citizen science into tribal communities. Many communities—in particular low-income communities and communities of color—are impacted by poor air quality. Lower cost air sensors provide increased public access to and understanding of air quality information. Providing these resources increases expertise in air quality science and improves understanding of air pollution and associated risk. This project expands tribal capacity for environmental protection by increasing access to air sensors and empowering communities to learn more about air quality and the actions they can take to protect their health and the environment.

Justification for Using Crowdsourcing and Citizen Science: The focus of this citizen science project is education and knowledge transfer, with direct public participation being the best teacher. Air quality professionals typically possess skills and training to use air quality monitoring equipment (such as low-cost sensors), manage the data, and interpret the monitoring results. However, this type of technology and information is not readily available to, nor understood by, the public. The low cost of some sensor systems and relative ease of operation makes it possible for non-experts to acquire and use these technologies, collect air quality information and apply the results to daily life. By partnering with tribal governments, EPA can help make low-cost sensors available to tribal members and provide training on the use of air pollution sensors.

C.4.6. EPA Sanitary Survey App for Marine and Fresh Waters[285]

Sponsoring Agency and Office: Office of Water

Authority: Crowdsourcing and Citizen Science Act

Activity Summary: The EPA Sanitary Survey App for Marine and Fresh Waters (App) allows users to gather sanitary survey data to identify sources of fecal contamination and potential harmful algal bloom (HAB) events affecting water quality. The App consists of surveys for both marine and fresh waters that is accessible using the ArcGIS Survey123 app. The Sanitary Survey App can be used on any device (i.e., phone, tablet, computer) in the field without the need for WiFi or Internet access. It includes photo storage, real time geolocation, links to websites such as the National Weather Service to access data, and free data storage. The data collected using the Sanitary Survey App can be used to identify sources and magnitude of a water quality problem, make decisions on beach closures and remediation actions, and develop predictive tools to ensure same-day swimming advisory decisions at swimming beaches.

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[285] The website for EPA Sanitary Survey App for Marine and Fresh Waters is accessible at https://www.epa.gov/beach-tech/sanitary-surveys-recreational-waters..

Advancement of Agency Mission: Although the collection of this data and use of the App is voluntary, the information that is collected by using the App can be used by EPA and states to ensure that recreation aspect of the Clean Water Act 101(a)(2) interim goal of water quality which provides for "the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water" is met. The information collected by the citizen science community could be used by states, territories and tribes to understand sources of fecal contamination that are impacting a beach or waterbody, so these sources can be remediated. Remediation of fecal quality. The data collected using the App can also be used to develop predictive models for making same-day decisions on swimming advisories. The App can also be used to identify areas where there might be harmful algal blooms. The citizen science community is increasingly interested in supporting the EPA, states and tribes with quality data that can inform and/or support their decisions and support restoration and remediation of recreational waters.

Justification for Using Crowdsourcing and Citizen Science: EPA recognizes the collective strength of crowdsourcing and citizen science (CSS) volunteers in being able to collect water quality data given that many jurisdictions lack adequate resources to monitor all their recreational waters. The data collected by CCS help public health officials make decisions to protect public health. These efforts can also ultimately promote safe public access to urban waterways and lead to aquatic ecosystem restoration.

C.4.7. Enhancing Tribal and State Cyanobacteria Monitoring using Citizen Science[286]

Sponsoring Agency and Office: Office of Research and Development

Authority: Crowdsourcing and Citizen Science Act,Clean Water Act

Activity Summary: This project expanded the capacity within States and Tribes in USEPA Regions 1 and 2 by providing specific targeted sampling and monitoring equipment, providing virtual and hands on training and education for identification, monitoring, and management of HABs, providing analysis for states/tribes on cyanobacteria impacted waters, and looking deeper into the social science aspects of people's perceptions of cyanobacteria on waterbodies that they utilize for recreation and subsistence living.

Advancement of Agency Mission: There is a significant need for understanding the type, occurrence, and extent of harmful cyanobacteria blooms in our Nation's waterbodies and national parks while simultaneously increasing the public awareness of cyanobacteria and their potential harm to human health and the environment. The outcomes from this project will provide new site specific and tribal wide perspectives on the scope and magnitude of the cyanobacteria problem tribal areas in EPA Regions 1 and 2. Additionally, the outcomes of this work will directly engage stakeholders and increase the general cyanobacteria knowledge and community resource understanding. Resulting crowdsourced data will be open to all through a public access webpage with enhanced data visualization tools and dashboards ready for direct utilization. This will provide a first ever tribal region perspective of cyanobacteria bloom formation, duration, species composition, toxicity, and overall composition. This project will support federal, state, and tribal water programs including drinking and recreational water, non-point source, and the like. An additional outcome will be the investigation of the social impacts of cyanobacteria on tribal communities at a regional and local scale.

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[286] There was no website provided for Enhancing Tribal and State Cyanobacteria Monitoring using Citizen Science.

Justification for Using Crowdsourcing and Citizen Science: CCS was chosen due to the characteristics of harmful cyanobacteria problems being ubiquitous, spatially and temporally elusive, and project proponents not having the resources to complete the objectives without crowdsourced assistance.

C.4.8. Equipment Loan Program for Water Quality Monitoring[287]

Sponsoring Agency and Office: Region 2 - New York

Authority: Crowdsourcing and Citizen Science Act,Clean Water Act

Activity Summary: Since 2015, the EPA Region 2 Citizen Science Water Monitoring Equipment Loan Program has provided access to field and laboratory equipment to volunteer monitoring organizations, citizen science groups, non-government organizations, academic institutions, local governments, Indian Nations, and other organizations. The available equipment includes instruments for measuring water quality parameters, pathogen monitoring, and microplastic collection. Organizations that participate receive hands-on training from EPA regional staff. All recipients must submit a Quality Assurance Project Plan (QAPP) before receiving their equipment, provide monthly updates, and submit a final report that summarizes the work and outcomes of the data collection. This program is open to citizen scientist organizations in New York, New Jersey, Puerto Rico, US Virgin Islands and eight Indian Nations. Priority is given to sites within communities of environmental justice concern and Indian Nations. The program runs annually in New York and New Jersey to reflect the general sampling season (May-November). Beginning in 2018, to accommodate more communities, the program began working with the EPA Region 2 Caribbean Science Consortium to set up a formal system of Equipment Loan Centers with university and non-governmental organization (NGO) partners throughout Puerto Rico and the US Virgin Islands. There are currently five centers in Puerto Rico and two in the US Virgin Islands, each with their own full set of equipment maintained by university staff.

Advancement of Agency Mission: Improving the Nation's water quality is one of EPA's highest priorities. The Agency recognizes the value of additional monitoring data to guide programs designed to improve the health of the streams, lakes, estuaries, and other water bodies. Due to budget constraints, it is not possible to collect water quality data for many water ecosystems. For over 25 years, volunteer water monitoring groups have played a valuable role in supplementing monitoring data collected by state regulatory agencies. This project supports the EPA mission of protecting human health and the environment by providing tools and training to citizen science groups. This program allows collection of data by local citizen science organizations, which can be used locally to better understand water pollution and protect water quality in local communities.

Justification for Using Crowdsourcing and Citizen Science: After becoming involved with Citizen Science in 2012, the EPA Region 2 office recognized the need for technical support, training, and equipment loans to support local citizen science organizations. EPA provided an initial grant that included purchase of equipment and other supplies. Today the program allows different groups to use the equipment for their own scientific needs—which contribute to environmental protection actions and decisions.

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[287] The website for Equipment Loan Program for Water Quality Monitoring is accessible at https://www.epa.gov/participatory-science/epas-equipment-loan-programs.

C.4.9. Escaped Trash Assessment[288]

Sponsoring Agency and Office: Office of Water

Authority: Crowdsourcing and Citizen Science Act,Clean Water Act

Activity Summary: The Escaped Trash Assessment Protocol (ETAP), developed by the U.S. Environmental Protection Agency's Trash Free Waters program, is a quantitative survey tool which provides a standard method for collecting and assessing litter data. The protocol is designed to be applied to a broad range of site types—e.g., parks, streets, parking lots, etc.—and environmental conditions—e.g., various hydrological and climatic regimes. This highly adaptable method for trash monitoring will provide practitioners and citizen scientists with a comprehensive and rigorous method for quantifying trash loadings. The tool can also be used to assess item age and level of fouling and analyze and compare across specific material types and categories of trash collected. This information can eventually be used to guide upstream source reduction decisions.

Advancement of Agency Mission: This effort supports EPA's mission to protect human health and the environment, and specifically addresses the priority goals to provide clean and safe water and to increase transparency and public participation. By working with stakeholders to develop a litter data collection protocol, EPA is supporting volunteer efforts to assess and monitor water quality. The Escaped Trash Assessment Protocol (ETAP) tool supports community monitoring efforts for participation in state and tribal water quality regulatory programs required by the Clean Water Act. In locations where states consider trash loadings in their 303(d) listings or Municipal Separate Storm Sewer System (MS4) permits, this protocol supports community monitoring efforts for participation in those water quality regulatory programs.

Justification for Using Crowdsourcing and Citizen Science: Citizen science and crowdsourcing are critical elements of the Escaped Trash Assessment Protocol (ETAP). Many municipalities lack the funding and capacity to collect rigorous data on litter trends in the community. Using this protocol, volunteers can collect, analyze, and interpret data—enabling them with the information necessary to share with local government leaders to inform upstream solutions (identifying hotspot locations and therefore where to focus illegal dumping enforcement, determining the most commonly found littered items to create more targeted educational material, informing trash provisions in stormwater permits/waterbody impairment listings under CWA 303(d), etc.). ETAP's inclusion in the Marine Debris Tracker helps crowdsource information collected via similar protocols to create more robust regionwide, nationwide, and worldwide data findings to inform decision making.

C.4.10.   Evaluating Air Pollution Sensors for Hot Spot Monitoring by Citizen Scientists[289]

Sponsoring Agency and Office: Office of Research and Development

Authority: Crowdsourcing and Citizen Science Act,Clean Air Act

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[288] The website for Escaped Trash Assessment is accessible at https://www.epa.gov/trash-free-waters/epas-escaped-trash-assessment-protocol-etap.

[289] The website for Evaluating Air Pollution Sensors for Hot Spot Monitoring by Citizen Scientists is accessible at https://www.epa.gov/innovation/region-2-evaluating-air-pollution-sensors-hot-spot-monitoring-citizen-scientists.

Activity Summary: This project is a field-validation of the New Jersey Department of Environmental Protection (NJDEP) Quality Assurance Project Plan (QAPP) template for identifying air quality hot spots. This is one of four air quality QAPP templates NJDEP has created and are now publicly available for use in communities with environmental justice concerns. Working with New Jersey and Rider University, this EPA funded project is assessing the efficacy of an air sensor network to monitor ozone, nitrogen oxides, and fine particulate matter using low-cost Aeroqual AQY-1 air sensors loaned by EPA's Office of Research and Development and administered by the Rider University faculty. Using the campus setting as a model for a traditional neighborhood design and Rider University students as an archetypal community group, this project serves as a real-world test of a standardized process for communities to collect screening-level data on potential hot spots.

Advancement of Agency Mission: This project advances EPA's mission of protecting human health and the environment by evaluating emerging air pollution measurement technologies that can be used in community level data collection. Participation in air monitoring empowers communities to advocate for their local air quality needs. The air sensors (which are operated by undergraduates on campus) also helps educate the next generation of scientists as they enter the workforce. The analyses from this project will also allow the EPA regional office and NJ Department of Environmental Protection to refine their goals of better air quality tools and resources for citizen scientists.

Justification for Using Crowdsourcing and Citizen Science: A crowd sourcing and citizen science approach was chosen because it allowed this demonstration of community monitoring of air pollution. The project helps government agencies understand the performance of lower cost monitoring technology, and how to work and communicate with communities on air quality concerns. It also provides better more usable and reproducible resources for community use going forward, i.e. the NJDEP QAPP templates.

C.4.11. Expert and User Perspectives on Environmental Change Due to HABs and Cranberry Bog Restoration[290]

Sponsoring Agency and Office: Office of Research and Development

Authority: Crowdsourcing and Citizen Science Act, Clean Water Act, National Environmental Education Act

Activity Summary: The citizen science collection for "Expert and User Perspectives on Environmental Change Due to HABs and Cranberry Bog Restoration" was implemented in the summer and fall of 2022. In this data collection, we conducted interviews with local recreation users to gain understanding of how they use freshwater ponds that are affected by harmful algal blooms (HABs) and cranberry bogs that were/are being considered for restoration to freshwater wetlands. We also conducted interviews with water and bog restoration managers to understand how they believe people are impacted by these environmental changes. The HABs data collection was on six freshwater ponds in Rhode Island and Massachusetts. These included both rural ponds on Cape Cod as well as urban ponds in the Providence metropolitan area. All of these sites have experienced HABs events in the past five years. Recreational users largely knew there were occasional water quality concerns in those ponds, but were not familiar with HABs specifically. Managers were concerned about inconsistent messaging to communicate HABs and a lack of understanding of how people are impacted by HABs. The bogs data collection was at six

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[290] The website for Expert and User Perspectives on Environmental Change due to Harmful Algal is accessible at https://www.epa.gov/water-research/human-dimensions-water-quality-research.

former cranberry bog sites in southeastern Massachusetts. These sites represented bogs recently retired, some that were mid-restoration, and others that have completed restoration. We sought to understand current use and how that was impacted by restoration. Recreational use was minimal, but people identified with the bogs while understanding that they were being retired because of external economic forces. Many saw the restoration efforts as an opportunity to continue their recreational use of the sites. Restoration managers highlighted the importance of connecting with communities in restoration efforts. They had varied restoration motivations, but all saw the value of early engagement with bog users early in the restoration process.

Advancement of Agency Mission: This research will improve EPA's ability to characterize recreational benefits of improved water quality in communities in New England and Ohio. Currently, very little is known about recreational uses and attitudes towards waterbodies in New England and Ohio. This limits the EPA's ability to assess the full economic and social impacts of nutrient over-enrichment and climate change. The proposed project will focus on attitudes and perceptions towards water quality, wetland restoration, and water-contact recreation, and knowledge about risks of harmful algal blooms. The findings from this study will be used by EPA to inform regional and state partners and communities that are implementing water quality policies and actions for wetland restoration of fresh water regarding the potential recreational, health, and environmental benefits of such policies and actions.

Justification for Using Crowdsourcing and Citizen Science: We were able to collect site-specific perspectives on the value of ponds and bogs. Using a CCS approach allowed us to reach as many users at the interested sites as were willing to participate in the project. This allowed us to have a more complete perspective of how changing environments affect behavior, while also collecting key informant understandings of these same sites. This helped us identify key challenges and opportunities to improve engagement and risk communication.

C.4.12. Improving Tribal Science and Citizen Science with Collocated Low-Cost Air Sensor Shelters[291]

Sponsoring Agency and Office: Office of Research and Development

Authority: Crowdsourcing and Citizen Science Act,Clean Air Act

Activity Summary: Recent improvements in sensor technology allow volunteers to measure air pollution in their communities. However, a challenge is that the quality of data obtained from low-cost air sensors often is not equal to more expensive monitors used by government agencies. A cost-effective way to assess the performance of low-cost air sensors (and create data correction equations that make sensor data more comparable to government monitors) is to test lower-cost sensors near the more expensive technology at regulatory monitoring sites. This project sets up small testing enclosures that will be set up at regulatory air monitoring sites. It will fund construction of air sensor shelters, with some being set up on or near Tribal lands, that can be used by Tribal, state and local air monitoring agencies. Tribal environmental agencies and participatory science organizations can use these air sensor testing shelters to conduct air sensor projects. Placement of collocated testing shelters at existing regulatory air monitoring sites allows for direct data comparisons between lower-cost sensors and more expensive

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[291] The website for Improving Tribal Science and Citizen Science with Collocated Low-Cost Air Sensor Shelters is accessible at https://www.epa.gov/innovation/region-4-and-6-collocated-air-sensor-shelters-tribes-and-citizen-science.

monitoring technology – a recommended method in EPA guidance for assessing air sensor measurement accuracy and uncertainty.

Advancement of Agency Mission: Accurate air quality measurements are the foundation of EPA's regulatory programs that reduce air pollution. This project sets up small testing enclosures that will be set up at regulatory air monitoring sites. It will fund construction of air sensor shelters, with some being set up on or near tribal lands, that can be used by tribal, state and local air monitoring agencies. Tribal environmental agencies and citizen science organizations can use these air sensor testing shelters to conduct air sensor projects. Placement of collocated testing shelters at existing regulatory air monitoring sites allows for direct data comparisons between low- cost sensors and more expensive monitoring technology –a recommended method in EPA guidance for assessing air sensor measurement accuracy and uncertainty.

Justification for Using Crowdsourcing and Citizen Science: This project provides participatory/citizen science infrastructure that can be used by local organizations to measure air pollution using lower cost sensors. The project encourages public participation in measuring air quality, which has the added benefit of increasing public understanding of air pollution. The project will provide infrastructure to assist with better quality CCS and more collaboration with regulatory agencies.

C.4.13. Local Environmental Observer Network[292]

Sponsoring Agency and Office: Office of Research and Development

Authority: Crowdsourcing and Citizen Science Act

Activity Summary: The Local Environmental Observer Network (LEO) allows community volunteers to report unique or unusual environmental events, which can be viewed on maps available to the public on the LEO website. The project was started in 2012 to respond to rapid environmental change that impacts the ability of rural communities to travel, access clean water, and harvest healthy foods. The LEO Network helps rural communities around the globe document environmental changes while in the field using the LEO Reporter App. By documenting the progression of change, traditional and local knowledge holders are able to better understand the environmental change and human health impacts and develop healthy adaptation strategies. Local observations that are contributed by volunteers include a description of the event (e.g., observation on unusual animal sightings, environmental conditions, and weather patterns) with a photo, location, and date. Entries are reviewed by project administrators at the Alaska Native Tribal Health Consortium and matched with topic experts who can share their expertise about the event. An interactive website bridges traditional and western scientific knowledge into a collection of partners and suite of resources, directing information about environmental events to communities around the world.

Advancement of Agency Mission: The project advances EPA's mission by supporting activities that build tribal capacity to manage environmental programs for a safe and healthy tribal environment.

Justification for Using Crowdsourcing and Citizen Science: A crowdsourcing and citizen science approach allows for useful two-way interaction between the public and scientific experts. The LEO network connects community members with technical experts and resources. The project was awarded as a Cooperative Agreement and U.S. EPA had substantial involvement in assisting the grantee in designing an effective platform that responds to the needs of diverse tribal communities.

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[292] The website for Local Environmental Observer Network is accessible at https://www.leonetwork.org.

C.4.14. Measuring Coastal Acidification in New England Estuaries[293]

Sponsoring Agency and Office: Region 1 - Boston

Authority: Crowdsourcing and Citizen Science Act,Clean Water Act

Activity Summary: Coastal acidification is threatening shellfish resources in all New England states. To assess this threat and to adapt to changing conditions, state coastal managers need high resolution measurements of pH and related parameters in estuaries. This project puts high quality and more affordable technology into the hands of citizen scientists to measure variability of coastal acidification among estuaries in New England.

Advancement of Agency Mission: One of EPA's primary missions is to protect water quality. The Clean Water Act requires that EPA establish water quality criteria and standards to protect aquatic life and other designated uses. This project aims to put new technology in the hands of citizen scientists to provide a more regional perspective on the variability of coastal acidification in New England to help communities adapt to climate change impacts. This project leverages the network of established partners as an opportunity for development of a network of monitors.

Justification for Using Crowdsourcing and Citizen Science: EPA's National Estuary Program (Clean Water Act Section 320) has identified ocean/coastal acidification (OCA) as a critical issue and funded installation of continuous monitors for measures of pH and CO2 in eight estuaries nationally, including three in New England: Casco Bay, Massachusetts Bay and Long Island Sound. The purpose of these sensors is to measure pH and CO2 and evaluate the variability of these parameters on a daily and seasonal basis. While these continuous sensors provide sufficient measurement precision at discrete locations, there is a need to increase data collection efforts at a wider spatial scale throughout New England coastal waters. Currently employed instruments for citizen-science data collection efforts— such as multi-meters or sondes (e.g. manufactured by YSI)— do not measure pH on the total scale, preventing the calculation of additional carbonate system parameters. The goal of this project is to equip citizen scientists, state-operated and commercial hatcheries, and other coastal managers with the tools to appropriately collect samples and make measurements of coastal acidification parameters in New England estuaries and coastal waters.

C.4.15. New England Stormwater Toolbox Equipment Loan Program[294]

Sponsoring Agency and Office: Region 1 - Boston

Authority: Crowdsourcing and Citizen Science Act,Clean Water Act

Activity Summary: This equipment loan program, established in 2011, and then reestablished in 2018 after a brief hiatus, provides a proven system that enables citizen scientist volunteers to conduct stormwater monitoring using water quality monitoring equipment and a consistent and quality-assured protocol for the collection of high-quality data. The framework behind it—the EPA New England Bacterial Source Tracking Protocol—is a method used to investigate potential human sources of bacterial contamination into stormwater systems, conveyances, and receiving waters. Polluted stormwater runoff in urbanized areas adversely impacts the Nation's waters and poses a significant

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[293] There was no website provided for Measuring Coastal Acidification in New England Estuaries.
[294] The website for New England Stormwater Toolbox Equipment Loan Program is accessible at https://www.epa.gov/participatory-science/epas-equipment-loan-programs.

threat to public health and the environment. Common pollutants include pesticides, fertilizers, oils, road salt, litter, sediment, and bacteria. A major source of bacterial contamination comes from aging, leaking water infrastructure and/or illegal connections of human sanitary sewers to municipal separate storm sewer systems. Furthermore, the Clean Water Act requires permitted municipalities to detect and eliminate these illicit discharges from local waterways, and it is the EPA and the states' responsibility to ensure they are complying with their permit. Thus, the stormwater toolbox equipment loan program volunteers assist EPA by increasing the number of monitored waterways for illicit discharges. Stormwater data collected by these organizations can be used to further support and bolster EPA investigation of a municipality's stormwater pollution control efforts. The data gathered by these citizen science groups is used to help EPA eliminate sanitary sewage from the stormwater system and upgrade stormwater infrastructure, thereby improving water quality in New England.

Advancement of Agency Mission: One component of EPA's mission is to protect water quality. The Clean Water Act requires criteria and standards to be met to protect human health, aquatic life, and other water uses, such as boating, swimming, and fishing. Stormwater discharge data collected by the volunteers will assist federal and state regulators in their efforts to eliminate contaminated sanitary sewage and upgrade stormwater infrastructure in communities across New England.

Justification for Using Crowdsourcing and Citizen Science: The New England Stormwater Toolbox Equipment Loan Program supports water quality monitoring by citizen science organizations and encourages community participation in activities that promote environmental awareness. Sampling surface waters for water quality analysis is expensive for State and local governments. Monitoring by citizen scientist volunteers presents a cost-effective alternative. The key is to ensure that the data abides to quality assurance and quality control levels acceptable under regulatory criteria. Using crowdsourcing and citizen science allows for testing of the quality and usability of the data, sampling efficiency, and sampling coverage.

C.4.16. Online Data Platform for Submerged Aquatic Vegetation in the Chesapeake Bay[295]

Sponsoring Agency and Office: Office of Research and Development - Region 3

Authority: Crowdsourcing and Citizen Science Act,Clean Water Act

Activity Summary: The goal of this project is the development of a publicly available online website platform for coordination and information sharing on submerged aquatic vegetation (SAV) monitoring programs in Chesapeake Bay to improve the dissemination of information, standardized protocols, and data to monitoring groups, other partners, stakeholders, and decision-makers. This project resulted in a fully fleshed-out series of four webpages that will serve as a one-stop-shop to coordinate and clearly communicate information on the Chesapeake Bay SAV Monitoring Program to stakeholders including monitoring groups, volunteers, researchers, resource managers, and the general public. The four webpages consist of a general Monitoring Program landing page and one webpage for each of the three tiers of the Chesapeake Bay SAV Monitoring Program. The webpages currently exist in wireframe form and include all text, graphics, photos, and hyperlinks, and are designed to easily fit into the existing Chesapeake Bay Program website infrastructure. This project also resulted in recommendations for

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[295] There was no website provided for Online Data Platform for Submerged Aquatic Vegetation in the Chesapeake Bay.

future development of the SAV Monitoring webpages. The Chesapeake Bay Program is currently using the deliverables of this project to get the webpages up on their public web site.

Advancement of Agency Mission: EPA's Chesapeake Bay Program Office coordinates scientific research on the health of the Bay and provides grants that drive local investment in reducing pollution and improving the water quality of local rivers and streams. These efforts are a critical part of Bay restoration programs that restore crab and oyster populations, rebuild wetlands, allow Bay grasses to thrive, improve stream health, and shrink the Bay's dead zones. This project will develop a platform, in coordination with Chesapeake Bay Program (CBP) partners Maryland, Virginia and the EPA Chesapeake Bay Program Office (CBPO), to improve monitoring of underwater grasses, or submerged aquatic vegetation (SAV). SAV are an essential but threatened living resource in many estuarine ecosystems. CBP and its partners are looking to pilot integration of this program as one tier of an overall coordinated monitoring approach that also integrates citizen science and traditional programs. To launch the Sentinel Site program, an online website platform is needed to coordinate efforts between participants, integrate information with the other two monitoring programs, provide standardized protocols to monitoring groups, and allow access to data. Data made available through this platform can be used by state partners, ORD and Region 3 to assess restoration progress, research water quality and nutrient pollution impacts on living resources and provide evidence for causal relationships between drivers of change and ecosystem responses.

Justification for Using Crowdsourcing and Citizen Science: None reported

C.4.17. Smoke Ready Communities: Examining Local Planning for Response to Wildland Fire Smoke Events[296]

Sponsoring Agency and Office: Office of Research and Development

Authority: Crowdsourcing and Citizen Science Act,Clean Air Act; National Environmental Education Act; OMB Memo M-15-16

Activity Summary: This project is a community-engaged project that aims to support efforts to reduce the public health burden of wildland fire smoke through an applied participatory research study entitled, Smoke Ready Communities. We designed this work with both action-oriented and investigative citizen science objectives and will work with county-based teams to develop tailored action plans for how their community will respond to future wildland fire smoke events that impact their community. Our research team will conduct semi-structured interviews using an open-ended questionnaire that ask for respondents' experiences and perspectives on the four areas listed, including: (1) prior experiences with extreme wildland fire smoke events, and how they perceive the impacts of these events on their communities as well as how their community responds to these events; (2) perceptions on health risks associated with exposure to smoke and existing strategies an individual can take to reduce exposure; (3) mental models for an ideal community-level response to wildland fire smoke and the necessary community capacity needed to facilitate an ideal response; and (4) thoughts and goals about developing a local smoke team and local smoke response plan. Results of this project will be used in three ways. First, the results will inform the broader conversation in the peer-reviewed literature on effective strategies for addressing complex social-environmental issues. Second, the

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[296] The website for Smoke Ready Communities: Examining Local Planning for Response to Wildland Fire Smoke Events is accessible at https://www.epa.gov/air-research/smoke-ready-communities-research-prepare-wildfires.

results will inform EPA program offices and regions on how to approach community-led collaborative projects, and leverage insights from for program and tool development and revision processes. Third, the county wildland fire smoke response plans will be used by local communities during future smoke events that require a public health response at the community level.

Advancement of Agency Mission: This project is one way that EPA is working to protect public health during wildfire smoke events by improving smoke forecasting abilities, identifying and communicating when and where smoke events are occurring, building local capacity to be Smoke Ready, and providing tools and resources for communities for health protection during smoke events. The purpose of this participatory research is to support local communities in developing a tailored strategy for how their community will respond to future wildfire smoke episodes and advance the state of the science on effective approaches to local collaborative planning processes that support community-defined outcomes related to local response and resilience to wildfire smoke episodes.

Justification for Using Crowdsourcing and Citizen Science: A participatory research approach was chosen because the research questions required collaboration and partnership with community members to scope and implement the project.

C.4.18. Smoke Sense[297]

Sponsoring Agency and Office: Office of Research and Development

Authority: Crowdsourcing and Citizen Science Act,Clean Air Act

Activity Summary: The overarching objective of the Smoke Sense project is to develop and maintain an interactive platform for building knowledge in individuals about wildfire smoke, health impacts and protective actions to reduce exposure that can improve health outcomes. A research approach that uses data collected from the Smoke Sense app users was employed. This method was chosen because it is mutually beneficial, serving both research purposes and as an educational resource on air quality and protective public health measures for app users. It allows for a two-way communication framework in problem formulation and dissemination of knowledge. Central to the Smoke Sense project is the smart phone application through which participants can explore current and forecasted daily air quality, maps of fire locations, satellite images of smoke plumes, and learn about ways to protect our health from smoke and poor air quality. Participation in the study encourages preventive health behaviors and invites users to record their smoke observations, play educational trivia games, and explore what other participants are reporting through the app. Various components of the app are intended to facilitate participants' progression in air quality awareness and adoption of desired health-promoting behaviors by tapping into the desire to gain and display expertise via learning. Reporting of smoke observations and health behaviors within the Smoke Sense project has two intended purposes: to support engagement with the issue from a personal perspective and to learn how the community of citizen scientists responds to wildfire smoke as a health issue. Keeping track of data related to our environment and our responses to the changes in our environment is known to support the development of new habits, e.g., running logs, diet logs, daily tasks, etc.

Advancement of Agency Mission: Understanding perceptions, motivations and barriers to behavioral change among impacted people can provide insights into how to improve health risk communication and achieve better public health outcomes during smoke events. To learn about how current

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[297] The website for Smoke Sense is accessible at https://www.epa.gov/air-research/smoke-sense-study-citizen-science-project-using-mobile-app.

recommendations are perceived, adopted, and adhered to by people impacted by smoke and identify strategies for successful health risk communication, EPA researchers launched a participatory science project called Smoke Sense. This has both investigative and educational objectives to develop and maintain an interactive platform for building knowledge about wildfire smoke, health, and protective actions to identify and bridge existing communications gaps. Participants engage with a smartphone app to explore current and forecast visualizations of air quality, learn how to protect health from wildfire smoke and record their smoke behaviors.

Justification for Using Crowdsourcing and Citizen Science: Crowdsourcing and citizen science is the only way to reach the public when and where they are experiencing the impact of wildfires.

C.5.   National Aeronautics and Space Administration (NASA)

C.5.1. Backyard Worlds: Planet 9[298]

Sponsoring Agency and Office: Science Mission Directorate

Authority: Crowdsourcing and Citizen Science Act

Activity Summary: Backyard Worlds: Planet 9, a citizen science project on the Zooniverse platform, invites members of the public to study complex infrared images from NASA's Wide Field Infrared Survey (WISE) mission for moving objects in search of new members of the solar neighborhood. Inspired in part by hypotheses about unseen planets orbiting the Sun beyond Neptune, the project aims to find planetary-mass objects, such as the coldest brown dwarfs, in the outer solar system or among the nearest stars. The project has discovered more than 3,500 brown dwarfs so far.

Advancement of Agency Mission: Backyard Worlds: Planet 9 explores the unknown by searching for and discovering new worlds near the solar system. By sharing the process of science with the public, Backyard Worlds: Planet 9 also helps promote NASA's core value of inclusion.

Justification for Using Crowdsourcing and Citizen Science: We found that the human inspection aided our search for moving objects. With more than one million images to inspect, we required help from volunteers to perform the image inspection.

C.5.2. Cloudspotting on Mars[299]

Sponsoring Agency and Office: Science Mission Directorate

Authority: Crowdsourcing and Citizen Science Act

Activity Summary: Cloudspotting on Mars is a project on the citizen science platform Zooniverse, where participants identify clouds in the atmosphere of Mars by analyzing observations made by the Mars Climate Sounder (MCS) instrument on the Mars Reconnaissance Orbiter (MRO). Clouds are a familiar feature in planetary atmospheres, and because they can both warm and cool the atmosphere, clouds have strong effects on the weather and climate of planets. MCS is an instrument that views the horizon of the planet at infrared and visible wavelengths to measure the temperature, water-ice, and dust content of the atmosphere on Mars. Due to the geometry of the observations, high-altitude clouds

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[298] The website for Backyard Worlds: Planet 9 is accessible at backyardworlds.org.

[299] The website for Cloudspotting on Mars is accessible at https://www.zooniverse.org/projects/marek-slipski/cloudspotting-on-mars.

appear as arch-shaped features in the MCS dataset. Participants in the Cloudspotting on Mars project inspect images to find and mark these arches. The primary scientific benefit of the project will be a geographic distribution of high-altitude clouds, which will be used to determine how the clouds form and of what they are composed. This will lead to a better understanding of processes that drive the variability of the Martian climate and advance scientific knowledge of processes that govern our solar system.

Advancement of Agency Mission: Through the "Cloudspotting on Mars" citizen science project, citizen scientists identify the times and locations of clouds in the atmosphere of Mars in observations made by the Mars Climate Sounder (MCS) instrument on the Mars Reconnaissance Orbiter (MRO). Utilizing the extensive MCS dataset, the results will further NASA's Planetary Science strategic objective "to advance scientific knowledge of the origin and history of the solar system," increasing the scientific return from MRO. The scientific motivation of this work addresses the Planetary Science Decadal Survey's Priority Question 10, "How have the myriad chemical and physical processes that shaped the solar system operated, interacted, and evolved over time?" by probing the composition, formation, and evolution of mesospheric clouds on Mars.

Justification for Using Crowdsourcing and Citizen Science: While identifying the features of interest (clouds in the Martian atmosphere) in the Mars Climate Sounder dataset by eye is a straightforward process, the volume of observations is prohibitively large to do so exhaustively by professional researchers. Automated techniques can efficiently search the dataset, but have difficulties to accurately identify clouds. CCS is a valuable tool to provide a standard set of cloud identifications that automated algorithms can be evaluated against.

C.5.3. Disk Detective[300]

Sponsoring Agency and Office: Science Mission Directorate

Authority: Crowdsourcing and Citizen Science Act

Activity Summary: The Disk Detective citizen science project invites the public to search for stars surrounded by dust-rich circumstellar disks, where planets form and often dwell. Volunteers examine images of each star taken from a variety of different observatories at different wavelengths to check them for background objects and other sources of contamination. Advanced users then research top disk candidates in the professional literature. Disk Detective Version 2.0 (the current version, launched May 2022) compares Wide-field Infrared Survey Explorer (WISE) images to 2MASS, Panoramic Survey Telescope and Rapid Response System (Pan-STARRS), Australia's SkyMapper telescope, and the un-blurred coadds of WISE imaging (unWISE). Discoveries from the project include the new class of long-lived "Peter Pan" disks, the oldest white dwarf with a disk, many disks in young moving groups, and a rare disk around a nearby young brown dwarf. The project has archived its findings on a publicly available database, at https://blog.diskdetective.org/2019/09/09/the-disk-detective-database/

Advancement of Agency Mission: Disk detective searches data from NASA's WISE mission, exploring to find evidence of nearby planetary systems. Also, by sharing the process of science with members of the public, Disk Detective also supports NASA's core value of inclusion.

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[300] The website for Disk Detective is accessible at diskdetective.org.

Justification for Using Crowdsourcing and Citizen Science: The large catalog of disk candidates to be examined benefits from human inspection. The team tried applying machine learning techniques to the data, but these techniques were only successful about 50% of the time.

Appendix D.   Crowdsourcing and Citizen Science under Other Authorities

This Appendix provides summaries of select crowdsourcing and citizen science activities voluntarily submitted by agencies that were conducted in FY19 and FY20 under authorities other than that provided by the Crowdsourcing and Citizen Science Act. Agency reporting on crowdsourcing and citizen science activities under other authorities was optional, and therefore the activities presented here are representative rather than comprehensive.

D.1.   Department of Commerce (USDOC)

D.1.1. Alaska Groundfish Tag Recovery[301]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Magnuson Act: 16 U.S.C Sect. 304 (e)

Activity Summary: The National Marine Fisheries Service (NMFS) Groundfish Tag Program of the Alaska Fisheries Science Center (AFSC) has released over 430,000 tagged groundfish in Alaska and West Coast waters since 1972. Tag reporting by industry is the primary means of data recovery and to date, nearly 40,000 tags have been returned by the fishing industry. Many of the species that are assessed by the AFSC are tagged, including sablefish, Greenland turbot, shortspine thornyhead, lingcod, spiny dogfish, Pacific sleeper shark, salmon shark, and Pacific cod. The program is focused on sablefish; to date approximately 400,000 have been tagged throughout the North Pacific. It is one of the longest ongoing tagging programs in the nation and is an example of successful cooperative research between researchers and industry. These tagging data are incredibly valuable and have been used to examine movement patterns, evaluate areal apportionment strategies of annual catch quota, validate ageing methods, examine growth, and have resulted in numerous scientific and management publications. The analyses continue to be updated and used in the sablefish stock assessment as well as for management and research of other groundfish species. The success of the tagging program is dependent on cooperation with the fishing industry. Although a small reward is offered for return of tags, for many people the main motivation for turning in a recovered tag comes from their interest in the resource rather than the reward and they are more interested in the letters they receive that accompany the rewards. These letters provide tag release location, total distance traveled, and growth of the fish. In response to industry's interest, AFSC has recently made tagging data available to the public via an interactive website that utilizes mapping software allowing one to visually track where specific tags were released and recaptured.

Advancement of Agency Mission: Data collected from the NMFS Groundfish Tagging Program are included in population dynamics models used to set annual allowable catches in the sablefish stock assessment. Tag data provides information on the rate of sablefish migration between the west coast, British Columbia, and Alaska and among Alaska management areas. This work directly relates to the MSRA priority of "collecting data to improve, supplement, or enhance stock assessments (Section 318(c)(i))." Because the success of this program relies heavily on the involvement of industry by turning in recovered fish tags and associated recovery data, this project involves collaboration and cooperative research between scientists and members of the industry. This work directly relates to the MSRA

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[301]   The website for Alaska Groundfish Tag Recovery is accessible at https://www.fisheries.noaa.gov/resource/map/alaska-groundfish-tagging-map.

Section 408 (a)(4) which requires the agency "to conduct research, including cooperative research with fishing industry participants."

Justification for Using Crowdsourcing and Citizen Science: The success of the tagging program is dependent on cooperation with the fishing industry. Tag reporting by industry is the primary means of data recovery and to date: nearly 40,000 tags have been returned by the fishing industry, in comparison to ~800 tag recoveries on scientific research cruises.

D.1.2. California Collaborative Fisheries Research Program[302]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Magnuson-Stevens Fishery Conservation and Management Act (MSA) (State authority: California Marine Life Protection Act)

Activity Summary: The California Cooperative Research Program (CCFRP) blends citizen science and cooperative research to monitor fish populations inside the state's network of marine protected areas and at nearby reference sites that are still open to recreational fishing. Faculty from Cal Poly and Moss Landing Marine Labs developed a scientifically rigorous hook-and-line survey in partnership with the NOAA Fisheries Southwest Fisheries Science Center and the recreational fishing industry (the Commercial Passenger Fishing Vessel, or CPFV, fishing fleet), where vessels (including vessel Captain and crew) are chartered to conduct the survey, and volunteers conduct all of the sampling. During a sampling event, volunteer anglers are assigned a station aboard the fishing vessel to fish, while scientific staff collect information on the environmental conditions, the catch by species, size of each fish, and tag a subset of fish. The vast majority of fishes caught (with some exceptions for age data collections or other special studies) are released with descending devices to increase post-capture survivorship. In 2016, CCFRP was expanded statewide to include six partner academic institutions, monitoring 14 protected areas and 14 adjacent reference sites spanning the entire coast of California. Over 1,650 volunteer anglers have caught more than 150,000 fish since 2007. The volunteers include all experience levels of anglers and ages from high school students to retirees. As one of the few citizen science programs contributing data to stock assessments and protected area management, the program inherently supports the sustainable management of domestic fisheries, and provides high-quality data to address a range of other management questions. In addition, the collaborative nature of the methodology allows the fishing community to work directly with scientists, increasing trust and confidence in the resulting data from both groups.

Advancement of Agency Mission: NMFS works with the Regional Fisheries Councils to assess fisheries stock status to inform fisheries management. There are a number of groundfish species for which we lack basic biological information and are undergoing stock assessments for the first time. The CCFRP provides the only long-term time-series of nearshore groundfish along the West Coast, and is also the only long-term study sampling the groundfish populations within marine protected areas. The CCFRP has also begun collecting fish ear bones (otoliths) that are used to age fish and fin clips for genetic studies. To date, CCFRP has encountered 171,086 fish (92 unique species) during 626 sampling trips. Additionally, current NMFS scientific surveys do not sample in waters shallow enough to accurately represent a number of managed groundfish species and many species live in rocky habitat and are difficult to sample.

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[302] The website for California Collaborative Fisheries Research Program is accessible at https://www.mlml.calstate.edu/ccfrp/.

Justification for Using Crowdsourcing and Citizen Science: The CCFRP is a long-term survey of fish populations and the marine protected area network developed with a number of goals including engagement of the fishing community, providing data to sustainable fisheries management and marine spatial planning. The Principal Investigators sought out stakeholder engagement from the very first planning stages of the program. The goal was to develop a scientifically rigorous sampling program that involved the fishing fleet, local fishing communities and agency scientists. The process by which scientific surveys are conducted and then feed into fisheries management is not always transparent. By involving the local fishing communities (local recreational fishing vessels and volunteer anglers) those individuals are invested in the program. Mason et al. (2020) found CCFRP volunteers had more positive opinions of marine protected areas after volunteering.

D.1.3. Community Collaborative Rain, Hail and Snow (CoCoRaHS) network[303]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Weather Service Organic Act, 15 U.S.C § 313

Activity Summary: Originally Co-sponsored by the National Oceanic and Atmospheric Administration and the National Science Foundation, the project is for citizen scientists of all ages and from all walks of life who can spend a few minutes per day collecting information on precipitation in their area. Volunteers register their location on the project website and can train themselves online or in-person with a local coordinator. By following a set of simple procedures and using a standardized rain gauge, volunteers measure and report their daily amount of rain (or melted snow) onto the project website, making it readily available in a centralized database. Options to report hail and/or other significant weather are also available, as well as advanced options such as evapotranspiration, drought impact reports and more. Major goals: Provide high quality precipitation data with at least one gauge every square mile in urban areas and one every 36 square miles in rural areas. Provide educational opportunities with a focus on climate literacy to project volunteers and the general public.

Advancement of Agency Mission: CoCoRaHS data is widely used by NOAA entities for a variety of purposes, including rainfall estimation, flood forecasting and warning, research, and so on. The regular, high-resolution collection of precipitation data, and the sharing of that data, advances NOAA's missions to understand and predict changes in climate, weather, oceans, and coasts., and to share that knowledge and information with others.

Justification for Using Crowdsourcing and Citizen Science: Climate monitoring is an absolutely essential element of climate services. It is imperative to know what the background climate conditions are and how they vary from place to place and over time. The traditional spacing of weather stations in the U.S. has been roughly one every 1000 to 1500 km2. With CoCoRaHS striving and sometimes succeeding in reaching one per 2 – 100 km2, the true nature of local variability in precipitation can be shown. The atmospheric science community values the CoCoRaHS high-density data while the science education community is setting goals for climate literacy. The popularity of rooftop weather stations may give the illusion that a high density of precipitation observations is easily available for use, but automated weather stations have been found to be less accurate than the 4-inch manual gauge that is required by CoCoRaHS and approved by NOAA.

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[303] The website for Community Collaborative Rain, Hail and Snow (CoCoRaHS) network is accessible at https://www.cocorahs.org/.

D.1.4. CrowdMag[304]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Coast and Geodetic Survey Act, 33 U.S.C. §§ 883a et seq.

Activity Summary: In partnership with the Cooperative Institute for Research in Environmental Sciences (CIRES), National Centers for Environmental Information (NCEI) started a crowdsourcing project (CrowdMag) to collect vector magnetic data from digital magnetometers in smartphones. The aim is to test whether we can obtain meaningful magnetic data from a large number of noisier measurements, thereby filling some of the gaps in the global magnetic data coverage. A phone's magnetometer measures three components of the local magnetic field with a typical sensitivity of about 150 to 600 nanotesla (nT). By combining data from vector magnetometers and accelerometers, the phone's orientation is determined. Using the phone's internet connection, magnetic data and location are sent to NCEI. We check the quality of the magnetic data from all users and make the data available to the public as aggregate maps. Currently, the CrowdMag project has about 70,000 enthusiastic users who have contributed more than 70 million magnetic data points from around the world. A global magnetic model, solely based on CrowdMag data, has been developed and is generally consistent with the large-scale component of models such as the World Magnetic Model (WMM). A unique contribution of the CrowdMag project is the collection of ground-level magnetic data in densely populated regions. By binning the data in closely spaced grids, it is possible to create magnetic anomaly maps of urban regions. The CrowdMag Day campaigns at the University of Colorado offer an opportunity for several student interns to become scientists for a day. For CrowdMag Day, teams of interns use the CrowdMag app to measure the Earth's magnetic field on and around the university campus. Analysis of magnetic data from multiple cell phones provided insights into the data stability of different types of phones. The CrowdMag team is currently developing a flight-mode version of the app for passengers to collect magnetic data while flying.

Advancement of Agency Mission: NOAA's National Centers for Environmental Information (NCEI) develops magnetic reference field models to aid navigation and scientific research. The NCEI uses magnetic data collected by observatories, satellites and ship/airborne surveys to develop magnetic models. However, the available measurements leave gaps in coverage, particularly for short-wavelength (<20 km) anomalies associated with man-made infrastructure ("urban noise") and the magnetic minerals in rocks ("crustal magnetic anomalies"). The data collected by the CrowdMag users were used to develop a low-resolution model of the Earth's magnetic field. By binning the data in closely spaced grids, we created magnetic anomaly maps of urban regions. The long-term goal of the project is to use the magnetic data collected by the citizen-scientists to improve NCEI's geomagnetic models and maps.

Justification for Using Crowdsourcing and Citizen Science: 1) Leverage the existing CrowdMag platform to enable a new cohort of non-traditional citizen scientists to explore the unseen magnetic world that surrounds us. 2) Magnetic mapping of shorter-scale magnetic anomalies is prohibitively expensive. The CrowdMag project tests the feasibility of mapping these anomalies via crowdsourced data from smartphones.

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[304] The website for CrowdMag is accessible at https://www.ngdc.noaa.gov/geomag/crowdmag.shtml.

D.1.5. Crowdsourced Bathymetry[305]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Coast and Geodetic Survey Act of 1947

Activity Summary: Crowdsourced bathymetry (CSB) is the collection and contribution of depth measurements from vessels, using standard navigation instruments, while engaged in routine maritime operations. While CSB data may not meet accuracy requirements for charting, the International Hydrographic Organization (IHO) recognizes its limitless potential for other uses. Data can be used to identify uncharted features, assist in verifying charted information, and help fill gaps where bathymetric data are scarce, such as unexplored areas of polar regions, around developing maritime nations, and the open ocean. The keys to successful CSB efforts are volunteer observers who operate vessels-of-opportunity, especially in places where nautical charts are poor or where the seafloor is changeable and hydrographic assets are not easily available. Most ships and boats are already equipped to measure and digitally record depth in coastal waters, and the measurement capabilities of vessels have been increasing. NOAA's National Centers for Environmental Information (NCEI) provides archiving, discovery, and retrieval of global CSB data and is now working to create a scalable point data store in a cloud environment to accommodate the ever-growing data volumes. The vision is to tap into the enthusiasm for mapping the ocean floor by enabling trusted mariners to easily contribute data to fill the gaps in our current bathymetric coverage.

Advancement of Agency Mission: This project aligns with Goal II of NOAA's Office of Coast Survey Ocean Mapping Plan: Map the Full Extent of U.S. Waters to Modern Standards. As the data holdings become more significant, Coast Survey expects to use crowdsourced bathymetry data to identify chart discrepancies, update charts, inform product development, and revise hydrographic survey priorities. Enhancing NCEI's database to accommodate the stewardship of crowdsourced bathymetry data will make it much easier for NOAA to attain this goal. This project also aligns with NOAA/DOC priorities and corporate interests to advance data integration and services and improve decisions by transforming data capabilities to support resilient coastal communities and economies for a data enabled economy.

Justification for Using Crowdsourcing and Citizen Science: CSB can be used to supplement the more rigorous and scientific bathymetric coverage done by hydrographic offices, industry, and researchers around the world. While CSB data may not always meet accuracy requirements, it does hold limitless potential for myriad other uses. If vessels collect and donate depth information while on passage, the data can be used to identify uncharted features, assist in verifying charted information, and help confirm that existing charts are appropriate for the latest traffic patterns. This is especially relevant considering that many soundings on charting products are pre1950. CSB data can also fill gaps where bathymetric data are scarce, such as unexplored areas of polar regions, around developing maritime nations, and the open ocean. CSB also has potential uses along shallow, complex coastlines that are difficult for traditional survey vessels to access.

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[305] The website for Crowdsourced Bathymetry is accessible at ngdc.noaa.gov/iho/ | ncei.noaa.gov/maps/iho_dcdb/ | iho.int/en/crowdsourced-bathymetry.

D.1.6. FISHstory (South Atlantic Fishery Management Council)[306]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Magnuson-Stevens Fishery Conservation and Management Act

Activity Summary: Historic fishing photos are used in the FISHstory project to document species and length composition data in the charter and headboat fisheries prior to when dedicated catch monitoring began in the 1970s. Knowing the species, number, and size of fish caught over time is critical in understanding the health of a fish population. These photos, an untapped source of this important biological data, will help fill this data gap identified in the for-hire South Atlantic fisheries. The FISHstory project is collaborating with Rusty Hudson, a retired fisherman, who has provided over 1,300 historic dock photos from his family's for-hire fleet in Daytona Beach, FL from the 1940s-1970s. Due to the large number of photos, the Council turned to citizen scientists to help with photo analysis. Using Zooniverse, an online crowdsourcing platform, volunteers are trained to identify and count fish and people in the photos. A Validation Team, comprised of fishers and scientists, verifies species identifications and counts when there is substantial volunteer disagreement. The FISHstory team also developed a method to estimate fish lengths from the historic photos and pilot tested it on one species, King Mackerel. Exploring fisheries of the past can help us better understand the health of fish stocks today and into the future. While identification of species can be challenging in historic photos, FISHstory demonstrated that crowdsourcing is a viable option for photo analysis. Due to the success of the FISHstory pilot project, the team is working to expand it into a full-scale project—initially focusing on collecting photos from other fishers and stakeholders across the South Atlantic region.

Advancement of Agency Mission: The FISHstory project is helping advance NOAA Fisheries and the SAFMC's mission to sustainably manage fisheries using the best available information. In the South Atlantic, few fishery dependent surveys were in existence prior to the 1970s and those that existed were limited in scope and lacked comprehensiveness and continuity. FISHstory is developing a standardized protocol for archiving and analyzing historic photos from the for-hire recreational fishery from the 1940s-1970s to document the beginnings of the South Atlantic for-hire fishery and collect data on catch and length composition prior to when dedicated for-hire monitoring programs began. The information in the photographs covers the nascent period of the recreational for-hire marine sector in the South Atlantic, which is widely regarded as a data-poor period for all finfish stock assessments in the US South Atlantic.

Justification for Using Crowdsourcing and Citizen Science: Analyzing photos can be labor intensive and time consuming. The FISHstory pilot project archived over 1,300 historic fishing photos. Past efforts to fund analysis of these historic photos have not been successful in part due to the resource-intensive nature of photo analysis. Due to the large number of photos, the FISHstory team turned to CCS and built an online crowdsourcing project in the Zooniverse platform where volunteers help classify photos. The crowdsourcing approach is being used to make the photo analysis more efficient and cost-effective. The protocols and techniques developed through this pilot project are being expanded to include photos from other locations throughout the region. Building the project in an online crowdsourcing platform and using CSS for analysis is making the expansion of FISHstory more cost effective.

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[306] The website for FISHstory (South Atlantic Fishery Management Council) is accessible at https://safmc.net/citizen-science/fishstory/ | https://www.zooniverse.org/projects/safmcadmin/fishstory.

D.1.7. GPS on Bench Marks[307]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Coast and Geodetic Survey Act of 1947 (33 U.S.C. §883)

Activity Summary: Get your community prepared for the modernized National Spatial Reference System (NSRS) by participating in the National Geodetic Survey's crowd-sourced data collection program called GPS on Bench Marks (GPSonBM). For the last 200 years, the Nation's foundational mapping infrastructure has relied on hundreds of thousands of survey marks set in the ground across the country. In 2007, NGS embarked on a decades-long endeavor to update the mapping infrastructure to take full advantage of modern technology and dramatically improve the accuracy of height measurements. To fully realize the billions of dollars in benefits that will come through moving to the modernized NSRS, Federal, State, and local governments and private sector firms will need to prepare and adapt their procedures and workflows. The GPSonBM program harnesses the power of partnerships across the country to move us all along the path toward realizing the benefits of the modernized NSRS.

Advancement of Agency Mission: The agency mission to define, maintain, and provide access to the National Spatial Reference System has historically required a tremendous field effort by federal experts. NGS is now embracing the emerging availability of geodetic-grade GPS equipment owned and operated by states and private agencies to maintain the reference system. This crowd- sourced data helps to improve the local accuracy of the national scale models and tools that NGS builds to serve the Nation.

Justification for Using Crowdsourcing and Citizen Science: NGS does not have the field staff or resources to collect this data on our own.

D.1.8. HABScope[308]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Harmful Algal Bloom and Hypoxia Research and Control Act (HABHRCA) 2014

Activity Summary: In Florida and soon in Texas, citizen scientists are helping to protect public health and the economy by supporting the Red Tide Respiratory Forecast. This beach-level risk forecast activated during red tide conditions tells beachgoers what impacts are expected to be at individual beaches at different times of the day. The Forecast saves those susceptible to red tide impacts visits to their doctors and emergency rooms and supports businesses that can lose thousands of dollars during red tides because visitors have not been able to make informed decisions about whether or not going to the beach is safe. The citizen scientists use HABscope, a portable microscope system that utilizes video and artificial intelligence (AI) to quickly analyze water samples for near real time cell counts of Karenia brevis, the organism that causes red tides in the Gulf of Mexico. These samples are combined with other environmental data and the result is the Red Tide Respiratory Forecast.

Advancement of Agency Mission: Under HABHRCA (2014) NOAA has a responsibility to develop and implement monitoring and forecasts of harmful algal blooms. . These blooms on the west Florida coast are quite variable, changing each day. In order to reliably forecast these blooms, we need more frequent observations at more beaches, which is beyond the capability of standard federal or local government

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[307] The website for GPS on Bench Marks is accessible at https://geodesy.noaa.gov/GPSonBM/.
[308] The website for HABScope is accessible at https://habscope.gcoos.org/ | https://habforecast.gcoos.org/.

monitoring programs. The CCS activity may provide sufficient information on these blooms so that we can forecast their location and impact, in response to HABHRCA.

Justification for Using Crowdsourcing and Citizen Science: The current monitoring programs operated by county, state, and federal partners can collect limited data on the presence of Karenia brevis (the "red tide" organism) in the waters of the Gulf of Mexico. As its toxins can cause respiratory irritation, two important problems needed to be solved: how to get more information on the presence of bloom concentrations, and how to make people more aware of the patchiness of these blooms, so people can safely go to the beach. The CCS approach allows us to get data from more places, and more often, along the Gulf coast, and engages and educates more of the public on red tide.

D.1.9. Marine Debris Monitoring and Assessment Project (MDMAP)[309]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Marine Debris Act

Activity Summary: The Marine Debris Monitoring and Assessment Project (MDMAP) engages NOAA partners and volunteers around the world in surveying and recording the amount and types of marine debris on shorelines using a rigorous methodology. MDMAP data are readily and openly accessible in a NOAA hosted database and application, following quality assurance and quality control procedures. This project contributes to meeting the mission of the Marine Debris Division of the Office of Response and Restoration, which is to "identify, determine sources of, assess, prevent, reduce, and remove marine debris and address the adverse impacts of marine debris on the economy of the United States, marine environment, and navigation safety." MDMAP is a tool for assessing, identifying, and determining sources of marine debris, in turn informing prevention and removal activities. As a project that engages volunteers and produces accessible information about marine debris, MDMAP also serves as an education and outreach tool that can inspire action by participants and users of the data.

Advancement of Agency Mission: The National Oceanic and Atmospheric Administration Marine Debris Program is authorized by Congress to work on marine debris through the Marine Debris Act, signed into law in 2006 and amended in 2012, 2018, and 2020. The Act requires the program to "identify, determine sources of, assess, prevent, reduce, and remove marine debris and address the adverse impacts of marine debris on the economy of the United States, marine environment, and navigation safety." The mission of the Program is to investigate and prevent the adverse impacts of marine debris. The Marine Debris Monitoring and Assessment Project supports the mission by engaging the public in investigating and monitoring the amount and type of marine debris on shorelines, documenting changes over time and geography. Results are used to document sources, identify targets for prevention, and to assess the efficacy of interventions.

Justification for Using Crowdsourcing and Citizen Science: Coastal communities along the U.S. West Coast, Pacific Islands, and Alaska who anticipated impacts from 2011 Japan Tsunami Debris identified a need for standardized monitoring protocols and centralized tools that local groups could leverage to monitor debris in their areas. The Marine Debris Program fulfilled this need through the launch of MDMAP, which has since been used by individuals, organizations, researchers, and government agencies around the world.

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[309] The website for Marine Debris Monitoring and Assessment Project (MDMAP) is accessible at Database application - https://mdmap.orr.noaa.gov/ | Training, participation, and data use resources- https://marinedebris.noaa.gov/monitoring-toolbox.

D.1.10. Meteorological Phenomena Identification Near the Ground (mPING)[310]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Weather Service Organic Act, 15 U.S.C. § 313

Activity Summary: The Meteorological Phenomena Identification Near the Ground (mPING) project uses observations from citizens about weather-related conditions near the ground along with a limited set of observations about weather impacts, such as flooding, tree and structure damage, etc. Observations are submitted using a simple smart-phone app and each observation includes GPS time and location. All observations are anonymous, in that no personal identifying data is collected. All observations are freely available for research use by anyone and to any government entity. A public display of the last two hours of data is available at https://mping.ou.edu/display

Advancement of Agency Mission: Observations from mPING inform forecasters about current conditions and weather in places that do not have observational instrumentation. The mPING data help numerical weather prediction model developers develop and refine better post-processing algorithms and techniques.

Justification for Using Crowdsourcing and Citizen Science: CCS is one of the ways to spread knowledge and awareness of the mPING project.

D.1.11. NWS Cooperative Observer Program[311]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Organic Act of 1890

Activity Summary: Long before the term citizen science was coined, the National Weather Service (NWS) relied on engaged citizen volunteers to collect and report basic meteorological and climate data from across the country. The NWS's Cooperative Observer Program (COOP) is a weather and climate observing network of, by, and for the people. Observations are collected at more than 8,000 sites on farms, in urban and suburban areas, National Parks, seashores, and mountaintops. The data are truly representative of where Americans live, work, and play and feed into the NWS mission of providing weather watch and warning information for protection of life and property. COOP has been in existence for over 130 years, since the first network of cooperative stations was formally codified in the Organic Act of 1890 that established the Weather Bureau, with informal participation at some sites reaching back 200 years. Many of the volunteers are multigenerational observers carrying on a long American tradition of weather observation dating all the way back to George Washington, Thomas Jefferson, and Benjamin Franklin, all of whom maintained weather records. Because of its many decades of relatively stable operation, high station density, and high proportion of rural locations, the COOP Network has been recognized as the most definitive source of information on U.S. climate trends for temperature and precipitation. In addition to NWS, FEMA relies on COOP rainfall and snowfall data as a primary information source for disaster declaration and relief efforts, and USDA risk management models get 80% of their data from COOP for agricultural disaster relief.

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[310] The website for Meteorological Phenomena Identification Near the Ground (mPING) is accessible at https://mping.ou.edu/ | https://mping.nssl.noaa.gov/.

[311] The website for NWS Cooperative Observer Program is accessible at https://www.weather.gov/coop/overview.

Advancement of Agency Mission: Observing programs, such as COOP, provide observations that feed into NWS mission of providing weather watch and warning information for protection of life and property.

Justification for Using Crowdsourcing and Citizen Science: This program has existed informally long before the Weather Bureau was created where volunteers were used to record climatic data. The program was codified in the Organic Act of 1890, and is still used today for this reason and more. Many of the volunteers enjoy being part of the program and part of the NOAA mission, and some of the volunteers are multigenerational observers.

D.1.12. Nurdle Patrol[312]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Coastal Zone Management Act

Activity Summary: Nurdle Patrol is a citizen science project run by the Mission-Aransas National Estuarine Research Reserve (Reserve) at the University of Texas Marine Science Institute in Port Aransas, Texas. We are looking to gather information about where nurdles (plastic pellets) are located, remove the nurdles from the environment, and create awareness about the nurdle issue. Citizen scientists search for nurdles for 10 minutes along riverbanks, beaches, and lake shorelines, and add the information of how many nurdles are found, location, and date into NurdlePatrol.org. Nurdles are the raw material to almost everything plastic and can be harmful to fish and wildlife when consumed.

Advancement of Agency Mission: The number of plastic pellets (nurdles) being found along riverbanks, ocean beaches and lake shorelines around the United States was a major data gap that Nurdle Patrol is filling. Nurdle Patrol surveys are identifying high plastic pellet concentration areas that can help guide cleanup efforts, new research on impacts of plastics in the environment, and possible sources of pollution.

Justification for Using Crowdsourcing and Citizen Science: None reported

D.1.13. NOAA OceanEYEs[313]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Magnuson-Stevens Fishery Conservation and Management Act

Activity Summary: As part of its efforts to monitor bottomfish species in Hawaii, the NOAA Pacific Islands Fisheries Science Center (PIFSC) launched the OceanEYEs Citizen Science project on September 15, 2020. Since launch, over 16,000 volunteer citizen scientists have made approximately 3 million classifications across nearly 300,000 underwater images during the Bottomfish Fishery-Independent Survey in Hawaii (BFISH). After logging into the OceanEYEs website, volunteers are guided through a short tutorial where they learn about the Hawaii Deep & bottomfish stock, stock assessment science, as well as the fish species being surveyed. They are taught how to recognize each of the key species and are then presented with underwater images from the survey. They are first asked if they see any fish in the image and, if so, are asked to mark the location of the fish and identify the species by name. Initial results suggest that the information provided by multiple Citizen Scientists can, when combined, rival

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[312] The website for Nurdle Patrol is accessible at https://nurdlepatrol.org/.
[313] The website for NOAA OceanEYEs is accessible at https://www.zooniverse.org/projects/benjamin-dot-richards/oceaneyes.

that provided by professional annotators. The work being done by OceanEYEs volunteers can allow NOAA scientists to look at new ways of counting fish and is being used to develop artificial intelligence solutions, training computers to identify fish and allowing NOAA scientists to deploy human expertise more efficiently. To-date, the work done by OceanEYEs citizen scientists is equivalent to just over one hundred FTE hours.

Advancement of Agency Mission: OceanEYEs is advancing the Agency's mission to continually improve stock assessment by providing additional means to research population abundance using underwater images collected during the population surveys. OceanEYEs is also advancing the Agency's mission to Maintain American Leadership in Artificial Intelligence by providing additional training data to improve machine-learning algorithms for fish detection. Finally, OceanEYEs is advancing the Agency's Education and Outreach mission by engaging citizen scientists in the stock assessment process, resource surveys, and species identification.

Justification for Using Crowdsourcing and Citizen Science: CSS represented an efficient method for annotating survey images while meeting education and outreach goals.

D.1.14. The Cooperative Shark Tagging Program[314]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Magnuson-Stevens Fishery Conservation and Management Act

Activity Summary: The Cooperative Shark Tagging Program is a collaborative effort between recreational anglers, the commercial fishing industry, and NOAA Fisheries to learn more about the life history of Atlantic sharks. Since launching in 1962, program volunteers have tagged more than 300,000 sharks of over 50 species and there have been more than 18,000 recaptures of these sharks, providing movement data on over 30 shark species. It is the longest running shark tagging program in the world and NOAA Fisheries oldest citizen science program. The original objective of this program was to document the distribution and movements of Atlantic sharks, while promoting conservation through catch and release. Data from this program provided the basis for the original essential fish habitat designations of federally managed Atlantic shark species and regularly provide updates to these habitat designations. Given the long-term, continuous time series, this mark-recapture program has not only been instrumental in shaping what we know about shark migration and distribution, but has also been used to define stock structure, document longevity, and validate age and growth in several species. This information is essential for stock assessment and effective management to prevent overfishing and ensure sustainable fisheries under the Magnuson-Stevens Fishery Conservation and Management Act. Additionally, Cooperative Shark Tagging Program data—combined with long-term environmental, fishery-independent survey, and/or satellite telemetry data—are revealing migratory cues, detailed migratory routes, and, in some cases, decadal shifts in seasonal distribution related to changes in population abundance and/or ocean warming.

Advancement of Agency Mission: The Cooperative Shark Tagging Program is NMFS oldest citizen science program and has allowed us to collect large amounts of data we would not have had access to without

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[314] The website for The Cooperative Shark Tagging Program is accessible at Shark Research in the Northeast – includes short section on the Cooperative Shark Tagging Program (link: https://www.fisheries.noaa.gov/new-england-mid-atlantic/atlantic-highly-migratory-species/shark-research-northeast) | Tagging Instructions and Resources for Cooperative Shark Tagging Program Volunteers (link: https://www.fisheries.noaa.gov/new-england-mid-atlantic/atlantic-highly-migratory-species/tagging-instructions-and-resources-volunteers).

extraordinary research costs due to the highly migratory nature of shark species crossing domestic and international boundaries. This program provides updates to essential fish habitat (EFH) designations for managed shark species and provided the data that formed the basis for the original EFH designations. Data from this program have also been used to define stock structure, document longevity, and validate age and growth in several shark species, all information essential for stock assessment and effective management to prevent overfishing and ensure sustainable fisheries under the Magnuson-Stevens Fishery Conservation and Management Act.

Justification for Using Crowdsourcing and Citizen Science: The use of citizen science to opportunistically tag sharks during normal angler activity has allowed us to collect large amounts of data throughout the North Atlantic. Without citizen science, we would not have the ability to collect the majority of this data without extraordinary research costs due to the highly migratory nature of shark species crossing domestic and international boundaries.

D.1.15.   The Hudson River Eel Project[315]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: NYS Department of Environmental Conservation

Activity Summary: American eels (Anguilla rostrata) migrate from oceans into East Coast estuaries, facing numerous challenges including over-harvesting, barriers to habitat access, and a negative perception from the public. In the Hudson River of New York State, a team of educators and scientists set up a monitoring program with three main goals: collect data on the annual migration of juvenile eels, get eels above barriers, and build a diverse community of "citizen scientists" who appreciate this unique species. Since 2008, staff from the Department of Environmental Conservation Hudson River Estuary Program and National Estuarine Research Reserve have recruited high school students, teachers, and community volunteers to check funnel-shaped nets installed in streams each spring. Up to 1,000 annual volunteers are trained to follow protocols set up by the Atlantic State Marine Fisheries Commission. This includes daily checking of nets, counting the transparent "glass eels", and releasing them above barriers like dams. Participants at a dozen sites have caught, counted, and released over a million eels. This project involves a wide range of communities that don't always have access to nature-based conservation efforts. Since eels are found in almost any waterway from city creeks to rural brooks, there is a natural range of geography and very diverse audiences. Teachers and students love the ecology lessons, community volunteers appreciate the chance to be involved in stewardship, and the public is intrigued by the mystery of the eel. The Eel Project has been promoted in podcasts, newspaper articles, videos, book chapters, and conservation awards. Thousands of people have been educated through presentations, and the project is a fun way for volunteers and their families to appreciate the eel's remarkable achievement as well as their own. Training and time are key to ensure safe data collection, and to reinforce the science behind the stewardship.

Advancement of Agency Mission: Data collected by volunteers through the Hudson River Eel Project has been submitted for inclusion in the 2022 American Eel Stock Assessment done by the Atlantic States Marine Fisheries Commission. This coast-wide assessment is used to determine fisheries management goals and conservation actions. The project also meets the Education Sector goals of the National Estuarine Research Reserve by engaging hundreds of volunteers each year in valuable science in their local communities. The Project brings greater focus on watershed connectivity issues, and several

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[315] The website for The Hudson River Eel Project is accessible at https://www.dec.ny.gov/lands/72898.html#Eel.

targeted dam removals are on streams well-documented by the Eel Project. The project introduces science research to young people from diverse communities, and continues to be part of pathways to environmental careers and leadership opportunities. The project is also part of a NOAA Catalyst Grant to expand into the NJ Research Reserve.

Justification for Using Crowdsourcing and Citizen Science: We chose to engage in citizen science for two main reasons. First, we wished to build an important data set of eel migration in the Hudson River for use by managers at the state-wide NYSDEC and the coast-wide Atlantic States Marine Fisheries Commission. We wanted to add to eel research that was already strong elsewhere, but could benefit from a wider geographic focus in the Hudson River Estuary. Second, by engaging community volunteers, we wished to build a diverse constituency of people that understand and care about eels. Because eels are found throughout the region, they can engage places and people that are traditionally under-served by many science initiatives. Eels themselves are a great link to wider environmental concerns of climate change, habitat conservation, and water quality. Our goals involve understanding eels in our estuary, and empowering citizens to become scientists.

D.1.16. eMOLT[316]

Sponsoring Agency and Office: National Oceanic and Atmospheric Administration

Authority: Integrated Coastal and Ocean Observation System Act of 2009 (ICOOS Act), Magnuson-Stevens Fishery Conservation and Management Act (MSA)

Activity Summary: The environmental Monitors on Lobster Traps and Large Trawlers (eMOLT) program uses cutting edge technology to empower members of the fishing industry to collect high-quality, oceanographic data. These data are collected by deploying low-cost probes on fishing gear. When fishermen haul the gear, the data transmit from the probe to a small computer in the vessel wheelhouse via Bluetooth. After generating a graphical display of the data, the computer uploads a summary of the data (average depth, average temperature, average time, and average position) to the cloud via satellite in near real-time. Once in the cloud, the anonymized data can be accessed by oceanographers and fisheries scientists. Previously, it was primarily used to ground truth oceanographic forecast models for the Northwest Atlantic, but future applications could include monitoring / validating the fisheries impacts of climate change.

Advancement of Agency Mission: Given the loss of research vessel time in recent years, the eMOLT data collected by commercial fishermen is able fill data gaps. The hourly samples collected on fixed gear, in particular, provides time series of ocean conditions that are needed to understand multiple time scales of variability. The real time data telemetered to shore as soon as the fixed and mobile gear lands on deck is automatically fed to ocean models. This system improves ocean forecast similar to the NWS operation to improve weather forecast. Given several million lobster traps on the bottom and hundreds of fishing trawlers dragging through a variety of depths, there is potential to collect much more data in the future.

Justification for Using Crowdsourcing and Citizen Science: Working with the fishing industry 1) allows the collection of data at different times of year than traditional NOAA cruises; 2) builds trust with the fishing industry by empowering them to document their experiences and providing them a valuable tool in

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[316] There was no website provided for eMOLT.

exchange for data collection; and 3) encourages innovative applications of low-cost hardware to keep the program cost effective

D.2. Department of Health and Human Services (HHS)

D.2.1. All of Us Research Program[317]

Sponsoring Agency and Office: National Institutes of Health

Authority: 21st Century Cures Act

Activity Summary: The All of Us Research Program is a historic effort to collect and study data and biological samples from one million or more people living in the United States, with the mission of accelerating health research and medical breakthroughs, enabling individualized prevention, treatment, and care for all of us. The program began national enrollment in 2018 and is expected to last at least 10 years. Participants provide data over time that researchers can use to learn more about how environmental, behavioral, and biological factors interact and contribute to human health. Already, this is one of the largest and most diverse datasets of its kind ever assembled. The program has been designed as a collaboration between researchers, health care providers, community partners, and participants. As part of this program, the All of Us Researcher Workbench was developed to make participant data available to a broad range of researchers (including, eventually, citizen and community scientists) and to answer important biomedical research questions. The Workbench is a cloud-based research platform and suite of custom tools available to authorized researchers. The Workbench allows researchers to interact with different tiers of data to create, review, and annotate cohorts and analyze unique datasets.

Advancement of Agency Mission: The mission of the NIH is to seek fundamental knowledge about the nature of living systems, and apply that knowledge to enhance health, lengthen life, and reduce illness. By establishing a diverse longitudinal cohort of one million or more people in the United States, All of Us will provide a valuable resource with health and lifestyle data from different communities and populations. This is designed to be one of the largest, most diverse and broadly accessible datasets of its kind ever assembled, to create opportunities for biomedical researchers to answer previously unanswerable scientific questions.

Justification for Using Crowdsourcing and Citizen Science: Anyone 18 years and older living in the United States who is eligible and willing may voluntarily enroll and contribute health, lifestyle, environmental data and biological specimens to the program. In addition, the involvement of participant partners in this project is critical, as they provide more than just their health data, but valuable insight into other aspects of design and implementation. For example, our participant ambassadors are part of the program governance, serving on committees that inform our scientific priorities, policies, and processes. The data and research platform in the All of Us Research Hub allows a broad range of researchers (including citizen scientists and community researchers in the future) to access data and assess the long-term impact of the environment, lifestyle, and biological factors on individual and population health and well-being.

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[317] The website for All of Us Research Program is accessible at <u>https://allofus.nih.gov</u>.

D.2.2. NCBI Codeathons[318]

Sponsoring Agency and Office: National Institutes of Health

Authority: Unknown

Activity Summary: NCBI Codeathons bring together students, educators, and researchers with diverse backgrounds to collaborate and create tools to solve complex biomedical research problems. They partner with other institutions and conferences to host week-long asynchronous virtual events. During the COVID-19 pandemic, NCBI has found that virtual events are not only safer, but provide a more accessible experience for participants. This is particularly true for non-traditional students and for universities with limited funding for travel.

Advancement of Agency Mission: The mission of the NIH is to seek fundamental knowledge about the nature of living systems, and apply that knowledge to enhance health, lengthen life, and reduce illness. Codeathons are a place to offer unique training opportunities in live and creative use of cloud technologies and other NIH based tools and datasets. These events also build bridges across multiple communities both locally and nationally for NIH, researchers, data scientists, software engineers, educators and everyone in between.

Justification for Using Crowdsourcing and Citizen Science: Codeathons are a unique tool to gain insight into how users and potential users understand and make use of NIH funded datasets, tools and resources and when and why they choose the alternatives. They also create and implement novel and creative solutions to complex problems that require expertise across numerous backgrounds. Codeathons are a place to offer unique training opportunities in live and creative use of cloud technologies and other NIH based tools and datasets. These events also build bridges across multiple communities both locally and nationally for NIH, researchers, data scientists, software engineers, educators and everyone in between. Finally, they are more flexible than other mechanisms as Codeathon topics can be decided at any point during outreach to fit the interests and needs of the institute/center, target group or communities being engaged.

D.2.3. NCI Comparative Oncology Program[319]

Sponsoring Agency and Office: National Institutes of Health

Authority: Unknown

Activity Summary: The NCI Comparative Oncology Program helps cancer researchers better understand cancer biology by studying naturally occurring cancers in pet animals (dogs and cats). The COP also conducts clinical trials of investigational oncology agents through a cooperative network of veterinary schools' teaching hospitals to evaluate new treatment options for cancer. Since cancers in animals share many features with human cancers, information gained through these clinical trials can benefit both pet animals and humans with cancer. Trial enrollment is dependent on pet owners enrolling their companion animals in different clinical trials. NCI has also established the Integrated Canine Data

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[318] The website for NCBI Codeathons is accessible at https://ncbi-codeathons.github.io | https://ncbiinsights.ncbi.nlm.nih.gov/event_listing_type/ncbi-codeathon/.

[319] The website for NCI Comparative Oncology Program is accessible at https://ccr.cancer.gov/comparative-oncology-program.

Commons (ICDC), a publicly-accessible cloud-based resource to allow analysis and integration of canine and human canine cancer data generated by oncology researchers and veterinarians.

Advancement of Agency Mission: The mission of the NIH is to seek fundamental knowledge about the nature of living systems, and apply that knowledge to enhance health, lengthen life, and reduce illness. The NCI Comparative Oncology enrolls pet dogs who have tumors similar to those that develop in humans into clinical trials. By studying these dogs, researchers not only are able to help pets and advance veterinary oncology, but these results and treatments may translate into effect therapies for human cancer.

Justification for Using Crowdsourcing and Citizen Science: This project relied on the participation of pet dogs, enrolled into oncology trials by their owners. The program could not exist without the participation of the public and their pets.

D.2.4. NLM Citizen Science Initiative[320]

Sponsoring Agency and Office: National Institutes of Health

Authority: Unknown

Activity Summary: NLM has established several initiatives to encourage citizen science collaborations between the NLM and local communities. These initiatives involve local communities in biomedical research. One example of this is the NLM Wikipedia Edit-a-thon, which is an annual campaign to edit Wikipedia articles that focus on health and medicine. NLM has also created resources for libraries, in partnership with SciStarter, to increase the involvement of the public in citizen science activities. One of these is a "Test the Waters" Citizen Science kit, offered to libraries and organizations to support citizen science outreach efforts in local communities through fun and accessible activities.

Advancement of Agency Mission: The mission of the NIH is to seek fundamental knowledge about the nature of living systems, and apply that knowledge to enhance health, lengthen life, and reduce illness. A major strategic goal of NLM is to "reach more people in more ways through enhanced dissemination and engagement pathways." NLM offers funding, training, community outreach, and partnerships to increase health awareness and access to NLM resources. NLM encourages member organizations to provide opportunities for members of the community to participate in citizen science activities. Through citizen science and crowdsourcing, NLM engages communities in addressing societal needs and accelerating biomedical science, technology, and innovation.

Justification for Using Crowdsourcing and Citizen Science: Collaborations between communities and researchers build capacity to address problems and meet research goals. Community participation in the research process also builds trust between NLM and the communities that we serve.

D.2.5. Partnerships for Environmental Public Health (PEPH)[321]

Sponsoring Agency and Office: National Institutes of Health

Authority: NIH Grant Authority

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[320] The website for NLM Citizen Science Initiative is accessible at https://www.nnlm.gov/initiatives/ccs.
[321] The website for Partnerships for Environmental Public Health (PEPH) is accessible at https://www.niehs.nih.gov/research/supported/translational/peph/index.cfm | https://www.niehs.nih.gov/research/supported/translational/community/index.cfm.

Activity Summary: The PEPH network brings together scientists, community members, clinicians, public health officials, and policymakers to better understand and advance the impact of environmental public health research at all levels, from community to nationwide. This program coordinates and integrates new and existing NIEHS-funded collaborative initiatives between communities and scientists focused on environmental public health and develops strategies to communicate public health messages to diverse audiences. PEPH breaks down silos to promote and advance community engagement and research translation efforts taking place within NIEHS grant-funded programs. As a community of practice, PEPH enables grantees and their partners to share community engagement (including citizen science) approaches and address common questions and issues across the different grant programs. In this way, PEPH has helped to inform and promote new concepts and existing strategies such as environmental health literacy and report-back of research results. PEPH has also developed an Evaluation Metrics Manual in response to grantee-identified needs. The PEPH Evaluation Metrics Manual was developed to provide grantees, project partners, and program staff with tangible metrics to use for planning and evaluating activities. The manual provides instructions for systematically analyzing program activities, outputs, and impacts and strategies for documenting program achievements in a standardized way. The manual was created to increase the ability of programs to measure success other than through peer-reviewed literature. It addresses the challenges that grantees face in measuring achievements related to building partnerships and translating project results to public health actions, outreach, education, and training. The evaluation manual can be accessed online -- https://www.niehs.nih.gov/research/supported/translational/peph/metrics/index.cfm

Advancement of Agency Mission: The mission of the NIH is to seek fundamental knowledge about the nature of living systems, and apply that knowledge to enhance health, lengthen life, and reduce illness. The PEPH program focuses on how the environment impacts individual and community health, and works to increase the impact of environmental public health research.

Justification for Using Crowdsourcing and Citizen Science: To understand and address the effects of local environmental concerns on community health, the PEPH program and the projects it supports must engage people at the local, regional, and national level. Community-engaged research and citizen science are the most effective and collaborative methods to achieve this, and lead to the development of culturally appropriate and impactful environmental public health research initiatives.

D.2.6. Science Education Partnership Awards (SEPA)[322]

Sponsoring Agency and Office: National Institutes of Health

Authority: 1991 NCRR Omnibus Budget Appropriation

Activity Summary: The SEPA program supports pre-kindergarten to grade 12 (P-12) and informal science education (ISE) activities that enhance the diversity of the biomedical, behavioral and clinical research workforce and foster a better understanding of NIH-funded biomedical, behavioral and clinical research and its public health implications. The SEPA program targets two primary audiences: (1) SEPA formal or classroom-based projects, providing STEM content, pedagogical expertise, and problem solving skills to teachers, students, and families in communities not generally supported by advanced and innovative educational practices; (2) SEPA informal science education (ISE) activities, conducted in

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[322] The website for Science Education Partnership Awards (SEPA) is accessible at https://nigms.nih.gov/capacity-building/division-for-research-capacity-building/science-education-partnership-awards-(sepa).

outside-the-classroom venues as well as in science centers and museums, target both workforce diversity and improved public health literacy. The SEPA program supports any area of NIH-funded basic or clinical research. Supported projects may involve developing curricula, mobile laboratories, science exhibits, and workshops that enhance the understanding of biomedical research and the life sciences. The materials developed as part of the SEPA program are made available to students, teachers, families and the general public. In FY 2022, the SEPA program was expanded to 17 NIH Institutes in addition to NIGMS. Examples of topics explored by students in these projects range from using DNA barcoding for studying biodiversity trends to collecting and analyzing data on arsenic content in well water to studying the health and lifestyle practices of the students themselves.

Advancement of Agency Mission: The mission of the NIH is to seek fundamental knowledge about the nature of living systems, and apply that knowledge to enhance health, lengthen life, and reduce illness. The goal of SEPA is to support educational activities that enhance the scientific training of students in pre-kindergarten to grade 12, including those from diverse backgrounds that are underrepresented in biomedical research. By providing students, teachers, and the general public with a better understanding of the life sciences, SEPA improves national health and science literacy.

Justification for Using Crowdsourcing and Citizen Science: The SEPA program is a peer reviewed NIH Research Education mechanism. SEPA projects focus on a wide range of health-related topics and develop resources to improve workforce diversity and public health literacy. SEPA therefore, promotes partnerships between scientists, teachers, education organizations, and students to develop interactive resources for training in the biomedical sciences. The resources developed by SEPA-supported educators are available for use by P-12 educators and for the general public. This is an example of effectively "crowdsourcing" the creation of educational materials.

D.2.7. The Dog Genome Project[323]

Sponsoring Agency and Office: National Institutes of Health

Authority: NIH Intramural Funding

Activity Summary: This project collects DNA samples from dog owners with all types of dogs to better understand how different genes interact to create traits in modern dog breeds, and how inherited diseases develop in susceptible breeds. Researchers are interested in genomic variation across dog breeds, particularly those with high levels of certain types of cancer. The goal is to identify genes and variants that create these susceptibilities. Because many diseases in dogs are similar to those in humans, findings from this project can provide insight into human diseases. The project is also interested in building genomic resources for the dog genomic and comparative genomic community through large scale sequencing, studies of breed relatedness, and development of markers for specific traits. Researchers are working with collaborators to assemble sequence of the worlds dog breeds, as well as wild canids and village dogs, to best understand the architecture of the dog genome. Researchers are also working to learn how various breeds relate one to another and how they originated. This contributes to efforts to find genes responsible for morphologic variation. When these are perturbed in humans, they are often associated with diseases, such as metabolic disorders. Finally, the project seeks to learn why dog breeds behave as they do to understand more about the genes that contribute to mammalian behavior. Further, these studies help us identify regulatory regions that likely

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[323]   The website for The Dog Genome Project is accessible at https://research.nhgri.nih.gov/dog_genome/index.shtml | https://www.facebook.com/DogGenomeProject/.

play a role in behavioral variation. Studies of cancer genetics identify genes and variants that contribute different cancers, susceptibility to these diseases, and tumor progression. Studies of morphologic variation identify genes that control breed specific traits such as body size or leg length that, when mutated, are responsible for human growth disorders. Data produced by the lab has impacted the work of nearly every companion animal geneticist in the world by providing a foundation for ongoing studies.

Advancement of Agency Mission: The mission of the NIH is to seek fundamental knowledge about the nature of living systems, and apply that knowledge to enhance health, lengthen life, and reduce illness. By studying the genetic underpinnings of various dog traits leading to morphological differences as well as disease predisposition in dog breeds, particularly cancer, The Dog Genome Project researchers are able to answer basic questions about genes, animal biology, and animal illness. In addition, they are developing new tools for understanding the architecture of the genome. The knowledge gained from these studies can inform how we understand human biology and disease.

Justification for Using Crowdsourcing and Citizen Science: This project relies on the contribution of canine biospecimens from dog owners as well as associated clinical, genetic and morphologic data. These contributions are critical for the establishment of a comprehensive database of canine genomic information and to answer key questions in genetic health care.

D.3.   Department of Homeland Security (DHS)

D.3.1. Crowdsourcing for Emergency Management[324]

Sponsoring Agency and Office: Federal Emergency Management Agency

Authority: Stafford Act

Activity Summary: The FEMA Crowdsourcing Unit uses crowdsourcing and Citizen Science to carry out the agency's mission of helping people before, during, and after disasters by coordinating with online volunteer disaster-response groups. These groups support their communities, response organizations, and fellow citizens nation-wide, with curated, accurate, timely, and actionable information during disasters. Some are well-established; others self-organize in response to exigent and unprecedented needs that arise. The Crowdsourcing Unit's role includes fostering coordination and collaboration, and communicating response needs and information gaps. Volunteer groups develop information products that provide situational awareness and can inform life-saving and life-sustaining activities. The Unit disseminates these products to decision makers in the National Response Coordination Center (NRCC) and emergency managers at the state and local level via FEMA's Geospatial Resource Center and daily coordination calls. The following are a few examples of products developed by volunteers in support of recent events. Crowdsourced Disaster Photo Map: Volunteers from GISCorps and CEDR Digital Corps mine social media and news outlets for images posted by citizens of disasters unfolding around them. Volunteers geolocate photos and upload them to a dynamic, interactive web map that provides valuable situational awareness to federal, regional, and local emergency managers within hours of an event. Crowdsourced Shelter Map: CEDR Digital Corps mine official social media accounts to develop interactive maps of evacuation routes, and shelter locations for humans, pets, and large animals. The volunteers convert textual shelter location data into consumable, interactive geospatial products.

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[324] There was no website provided for Crowdsourcing for Emergency Management.

Advancement of Agency Mission: FEMA's mission is to help people before, during, and after disasters, which depends, in part, on the ability to quickly understand what's happening on the ground. Crowdsourced information helps fill in gaps in official data, and ultimately better enables the agency to carry out its mission.

Justification for Using Crowdsourcing and Citizen Science: Many people are compelled to volunteer after a disaster. Some find their way to distribution centers to hand out meals or water, but others choose to volunteer online. Digital volunteers mine social media for disaster photos, provide maps of evacuation routes and shelters, fact check and control rumors on social media, identify and respond to rescue requests when 911 is overwhelmed, and amplify official emergency messaging. Until recently, coordination between official response organizations and online-volunteer contributors was lacking. Although quite a few of these online-volunteer groups engaged in these activities even without coordinating with FEMA, the Crowdsourcing Unit now creates a bridge between the volunteer groups and the emergency management community, providing access to this otherwise unavailable information.

D.3.2. Geospatial Damage Assessments[325]

Sponsoring Agency and Office: Federal Emergency Management Agency - FEMA Response Geospatial Office

Authority: Unknown

Activity Summary: FEMA has developed a Geospatial Damage Assessment (GDA) analytical capability that relies on three key components to be successful: people, processes, and technology. The result of the analysis is vital to help FEMA understand the full extent of disaster impacts with a goal of data delivery within 72 hours post-incident. This analysis uses technologies including Geospatial Information Systems (GIS)-based modeling, remote sensing, and an online application that can accommodate 100s of participants. The result is initial situational awareness and expedited recovery planning. To achieve the 72-hour delivery goal, a significant number of trained analysts are required. To fill that role, FEMA relies on crowdsourced support. Additionally, FEMA has not just internally trained hundreds of employees, but also partnered with the Civil Air Patrol to make training available to their members. Geospatial Damage Assessments have the following advantages. Cost Effectiveness: GDAs reduce the requirement for field team deployments and provide vital information for those who do deploy. Timeliness: GDAs are ready to use within an hour of notification of the requirement (pending imagery availability). Comprehensiveness: All available imagery is analyzed, which provides the most comprehensive view of disaster damage.

Advancement of Agency Mission: All response organizations (public, private and non-profit) need to understand the size, scope, and extent of an incident. This information is essential for operations because it helps inform decisions including resource deployments and the prioritization of critical services following an incident. Geospatial Damage Assessments are essential to providing that data. Through our crowdsourcing platform, the Civil Air patrol was able to provide support in the aftermath of Hurricane Ian to help FEMA quickly assess over 60,000 structures. Recovery used the data to provide over $72 million in direct assistance to survivors. The Joint Field Office used the data to determine the

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[325] The website for Geospatial Damage Assessments is accessible at https://gis-fema.hub.arcgis.com/pages/geospatial-da-training.

location of damages, cross referenced with registration data to determine outreach locations. USACE used the data to determine locations that required a site visit.

Justification for Using Crowdsourcing and Citizen Science: In the aftermath of a disaster, many people want to help in any way they can. This activity, including the training, provides a mechanism for people to provide support to disaster survivors without deploying to dangerous impact zones. The activity is also available to anyone with a computer, no matter their physical condition, allowing participation from those who would otherwise be unable to deploy to the field and provide direct assistance.

D.4.   Department of the Agriculture (USDA)

D.4.1. Asian Longhorned Beetle (ALB)[326]

Sponsoring Agency and Office: Marketing and Regulatory Programs

Authority: Plant Protection Act Section 7721

Activity Summary: NA

Advancement of Agency Mission: Asian longhorned beetle (Anoplophora glabripennis), or ALB, is a destructive wood-boring pest that feeds on maple and other hardwoods, eventually killing them. It most likely came to the United States inside wood packaging material from Asia. For eradication efforts to succeed, APHIS relies on public reporting, and residents in infested areas must remain on the lookout for this destructive pest. This project included a novel public outreach tool with an augmented reality trading card. Citizens interact with the card to learn more about the pest and alert APHIS to ALB sightings.

Justification for Using Crowdsourcing and Citizen Science: None reported

D.4.2. National Wildlife Research Center Hawaii Field Station Rose-ringed Parakeets[327]

Sponsoring Agency and Office: Marketing and Regulatory Programs

Authority: Animal Damage Control Act of 1931 as amended 22 December 1987

Activity Summary: Rose-ringed parakeets (Psittacula krameri) are among the most invasive bird species worldwide. In their introduced ranges, populations of these species have caused negative impacts on native species, habitats, economies, and human safety. The National Wildlife Research Center Hawaii Field Station is attempting to advance the science for controlling the negative effects of Rose-ringed Parakeets on agriculture and the environment in Hawaii. Scientific investigations have included studies of abundance, distribution, evaluations of control strategies that have been used, evaluations of potential control strategies, and population projections under various control strategies and levels of management. Citizen science data was employed to determine 1) the distribution of the species worldwide to predict where they will ultimately occur on the Hawaiian island of Kauai, and 2) the behavior of the species at feeders to facilitate the delivery of population control agents such as fertility control.

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[326] There was no website provided for Asian Longhorned Beetle (ALB).
[327] There was no website provided for National Wildlife Research Center Hawaii Field Station Rose-ringed Parakeets.

Advancement of Agency Mission: The National Wildlife Research Center Hawaii Field Station is attempting to advance the science for controlling the negative effects of Rose-ringed Parakeets on agriculture and the environment by using 1) information on the distribution of the species worldwide to predict where they will ultimately occur on the Hawaiian island of Kauai, and 2) the behavior of the species at feeders to facilitate the delivery of population control agents such as fertility control.

Justification for Using Crowdsourcing and Citizen Science: Observation data was available on existing citizen science platforms containing 1) information on the distribution of the species worldwide to predict where they will ultimately occur on the Hawaiian island of Kauai, and 2) the behavior of the species at feeders to facilitate the delivery of population control agents such as fertility control.

D.4.3. Wildlife Services National Wildlife Research Center Study (QA-3074)[328]

Sponsoring Agency and Office: Marketing and Regulatory Programs

Authority: Unknown

Activity Summary: Wildlife Services is interested in understanding why certain species are better at adapting to the challenges of urban environments. Recent research has focused on evaluating behavioral adjustments made by animals, particularly how animal behavior changes in urban environments, finding that animals generally become bolder and more aggressive. Understanding these behavior adjustments is particularly important for larger carnivore species like coyotes, where the development of bold and aggressive behavior could create more risk for humans, such as coyotes attacking pets or people. The goal of this national assessment of coyote behavior is to gather information from urban and rural areas throughout the US to help determine what type of behavior change is occurring and whether these changes are common throughout different cities.

Advancement of Agency Mission: Gathering data from people around the United States (and a couple of international spots) on coyote behavior in urban versus rural areas. This information improve our understanding about urban coyote behavior and opportunities to minimize human-wildlife conflicts.

Justification for Using Crowdsourcing and Citizen Science: None reported

D.5. Department of the Interior (DOI)

D.5.1. 2021 South Bighorns III PIT Project and 2022 Crooked Creek I PIT Project[329]

Sponsoring Agency and Office: Bureau of Land Management

Authority: Federal Land Policy and Management Act, Section 110 of National Historic Preservation Act, 2015 BLM Buffalo Field Office RMP

Activity Summary: Ten volunteers, traveling from Idaho, Montana, North Carolina, Nebraska, and Wyoming, contributed 376 hours to the 2021 South Bighorns III Passport in Time (PIT) project located within and adjacent to the Gardner Mountain Wilderness Study Area (WSA) in southern Johnson County, Wyoming, the week of July 18, 2021. The project area is within the South Bighorns Cultural Resource Project Plan boundary and is very remote and difficult to access. Working with an adjacent private

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[328] There was no website provided for Wildlife Services National Wildlife Research Center Study (QA-3074).

[329] The website for 2021 South Bighorns III PIT Project and 2022 Crooked Creek I PIT Project is accessible at www.passportintime.com.

landowner greatly facilitated access to the project area. The group of volunteers, working with three BLM archeologists, completed 207 acres of intensive class III pedestrian inventory, completely rerecorded six previously identified archeological sites, and identified and fully recorded nine new archeological sites. Seven volunteers contributed 270 hours to the Crooked Creek I PIT project in southern Johnson County, Wyoming, the week of June 26, 2022. Volunteers traveled from California, Texas, North Carolina, Montana, and Wyoming to work in challenging hot dry summer conditions. The group persevered and complete 290 acres of intensive class III pedestrian survey. A total of 14 new archeological sites were identified and intensively recorded and the group also updated site recordings for six other previously recorded sites. Intensive recordings in the field for both the 2021 and 2022 PIT projects included photogrammetry documentation of rock art sites (both prehistoric and historic), field mapping and feature drawings, and detailed artifact recordings. The group also accomplished an intensive survey of rock faces for rock art and inscriptions, something that requires patience and many eyes to complete. The information gathered allowed the BLM to evaluate all of the sites for the National Register of Historic Places (NRHP) and identify management priorities for the cultural resources in the area.

Advancement of Agency Mission: The Buffalo Field Office uses the results of the PIT projects to manage cultural resources on BLM surface estate. Specifically, sites are evaluated for theNRHP and assigned a Use Allocation (per BLM 8110 manual). The projects also fulfill the Buffalo Field Office 2015 Resource Management Plan goals for Heritage Resources (HR):1.2 (Develop a public outreach and education program to instill a preservation ethic in the public regarding archeological and historic resources), HR:3 (National Register eligible and unevaluated cultural resources are protected), and HR:4 (Cultural resources are identified, preserved, and protected, while remaining available for appropriate uses by present and future generations). Additionally, the 2021 South Bighorns III PIT Project meets management goals outlined in the 2018 South Bighorns Cultural Resource Project Plan .

Justification for Using Crowdsourcing and Citizen Science: Public participation allows for those with an interest to support BLMs efforts to document, understand, and preserve these unique and irreplaceable resources. The time and expertise shared enables the Bureau to more efficiently complete its mission while promoting sound resource stewardship. These projects at the BLM Buffalo Field Office give the volunteers an educational experience, knowledge of cultural resources on public lands, and the opportunity to contribute to public land stewardship.

D.5.2. Adobe Wall Climate Change Resilience Project[330]

Sponsoring Agency and Office: National Park Service

Authority: NPS Organic Act

Activity Summary: The Southern Arizona Office (SOAR) of NPS, in cooperation with the NPS Desert Research Learning Center (DRLC), University of Arizona College of Education, and Walter Douglas Elementary School, worked under a National Science Foundation grant with SciGirls, a PBS television show, on a citizen science project for 5th and 6th grade girls. The girls from Walter Douglas Elementary represent marginalized and underserved groups in STEM and the NPS workforce. Through the project and experiments, the girls help park managers better protect historic adobe structures against climate change. Experiments carried out by NPS staff had already found that the high intensity storms can and are causing substantial damage to earthen architecture. Finding effective methods to preserve these

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[330] There was no website provided for Adobe Wall Climate Change Resilience Project.

structures from intense storms as well as long soaking rains was the primary goal of this project. In the first year of the project, the girls built adobe test walls and then applied different protective plasters. Using data on how much damage occurred to the test walls after rain application from a hose, the girls suggested the best plaster to use. In the second year of the project, the girls are experimenting with application methods for one type of plaster that is currently used by multiple NPS units. Their findings will provide baseline data for resource managers, add to a growing body of data on preservation of earthen architecture, and help guide cultural resource preservation within NPS.

Advancement of Agency Mission: The adobe wall research questions that the girls address will help guide decisions on resource management practices for historic adobe structures. For instance, in the first year, the girls investigated water (simulated rain) resistance for a wide variety of plaster types. Their data helped NPS scientists decide which plaster types to test in a larger, more controlled experiment, for return on investment of staff time and cyclic funding. In year two, the girls are testing the simulated rain resistance of just one plaster type, but applied in two different ways. Both application methods are currently being used at different NPS units; confirming (or negating) suspicions that one method is superior will further inform best practices in the historic preservation of our nation's cultural resources.

Justification for Using Crowdsourcing and Citizen Science: CCS was an integral part of the NSF grant that funded this project via a partner.

D.5.3. Alaska Bee Atlas Community Science[331]

Sponsoring Agency and Office: Bureau of Land Management

Authority: Federal Land and Policy Management Act, 43 USC Chapter 35.

Activity Summary: The Alaska Bee Atlas is a collaborative program to collect bees and associated habitat data by federal and state biologists in Alaska. Participating scientists are filling data gaps on Alaska's insect pollinators. Participation was broad in 2020 and 2021 with individuals representing ten different state and federal agencies. The Alaska Bee Atlas is managed by the Alaska Center for Conservation Science (ACCS) at the University of Alaska Anchorage and created by ACCS and the Bureau of Land Management (BLM) with input from the Alaska Pollinator Coordination Group (APCG). This program leverages agency biologists who are already in the field for other purposes to sample data deficient areas. The creators of the Alaska Bee Atlas recognize all pollinators are valuable and lacking data, but first are focusing data collection on bees.

Advancement of Agency Mission: Alaska Bee Atlas community scientists expand the sampling efforts across Alaska to fill in more data gaps. It also provides opportunities to educate the public about the importance of Alaska's pollinators and to engage the public in meaningful science. Data provided by community scientists provides BLM and partners with data to inform decision-making and manage and conserve pollinators and their habitat.

Justification for Using Crowdsourcing and Citizen Science: Opportunistic sample by trained dedicated members of the public is beneficial to efficiently fill data gaps while providing education and outreach to the public on bees.

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[331] The website for Alaska Bee Atlas Community Science is accessible at https://accs.uaa.alaska.edu/wildlife/ak-bee-atlas/.

D.5.4. Aquatic Insect Monitoring in Grand Canyon[332]

Sponsoring Agency and Office: U.S. Geological Survey

Authority: Organic Act of 1879, The Grand Canyon Protection Act of 1992 (Public Law 102-575)

Activity Summary: Aquatic insects are commonly used to gauge the health of stream and river ecosystems yet collecting enough samples to adequately characterize a river segment as long as the Colorado River through Grand Canyon (+250 miles) would be essentially impossible using traditional sampling methods. The goal of this project is to monitor the Colorado River ecosystem and its response to flow management from dams, particularly Glen Canyon Dam. Aquatic insects are the cornerstone of food webs in and around rivers. Quantifying the abundance and diversity of aquatic insects over time and space is important to understanding the health of river ecosystems and how rivers are affected by dam management policies. Since 2012, our group has been collaborating with river guides, private boaters, and educational groups to deploy light traps to collect adult aquatic insects in this river segment. Every night in camp, community scientists set out a light trap at the river's edge for one hour at dusk. Traps consist of a fluorescent black light placed on top of a plastic pan containing ethanol. At the end of the hour, the sample is poured into a bottle and eventually brought back to the lab where its contents are counted and identified by USGS personnel. These community scientists have generated an impressive quantity of samples and data that allows us to ask and answer questions about the Colorado River that are truly unprecedented in scale and yielding fundamentally new insights into the Colorado River ecosystem. Our results demonstrate that the abundance and diversity of aquatic insects in the Colorado River is constrained by hydropower production at Glen Canyon Dam. These results informed the design of experimental Bug Flows that have been released from Glen Canyon Dam in 2018 to 2020 and 2022 to try to improve the health of the Colorado River ecosystem.

Advancement of Agency Mission: The mission of the USGS Southwest Biological Science Center is to provide science in support of adaptive management experimentation at Glen Canyon Dam. This project has fundamentally advanced this mission by identifying links between flow management policies and the health of river food webs, including native endangered fish and highly valued sport fish like rainbow trout. This community science effort allows us to ask and answer questions about the Colorado River that are truly unprecedented in scale, such as how hydropower releases from Glen Canyon Dam affect aquatic insect populations and the health of river food webs, how the phenology (seasonal timing) of aquatic insects varies by species and with distance downstream from the Dam, and how aquatic insect populations vary from year-to-year throughout the entire Grand Canyon.

Justification for Using Crowdsourcing and Citizen Science: Community science has been essential to the success of this project. Sampling aquatic insects on large scales is logistically challenging for typical research groups of only a few people. However, sampling aquatic insects on a large scale, over long periods of time, can be achieved by working cooperatively with people who are on the river every day, like professional river guides and private boaters. Because of this community science collaboration, USGS researchers are able to collect samples of aquatic insects throughout the Colorado River and its tributaries throughout the entire year. More than 300 people have volunteered to sample aquatic insects through this project, totaling 13,062 hours between 2012 and 2022.

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[332] The website for Aquatic Insect Monitoring in Grand Canyon is accessible at https://www.usgs.gov/centers/southwest-biological-science-center/science/bug-flows-improving-food-web-health-giving-bugs; https://www.usgs.gov/centers/southwest-biological-science-center/science/community-science-grand-canyon.

D.5.5. Assessing the Health of Otter Creek Inner Harbor and Potential Pathways to Remediate Problems[333]

Sponsoring Agency and Office: National Park Service

Authority: NPS Organic Act

Activity Summary: For many years, community members who live around and use Otter Creek (a village in Mount Desert, Maine) have been concerned about declines in the health of the inner harbor, indicated by marked declines in populations of fish, clams, and other organisms. Problems appear to be related to climate change, tidal restrictions caused by a causeway built in 1939, and contamination caused by a water treatment facility that dumped contaminated effluent into the inner harbor. This project aims to assess the health of the inner harbor, causes of problems, and options to remediate problems. Restoring the health of the inner harbor will help community members re-establish fishing, clamming, recreation, and other historical uses of the cove, which is important to the community.

Advancement of Agency Mission: The project advances the mission of NPS to preserve natural and cultural resources and to provide for the enjoyment, education, and inspiration of this and future generations. The project aims to identify values and conditions of a harbor within and adjacent to the park boundary and to identify methods to improve the ecological condition of the harbor. NPS plans to act on some of the recommendations from the project to improve conditions of the harbor.

Justification for Using Crowdsourcing and Citizen Science: The project question was posed by the community and the community held knowledge and data essential to answering the question. Thus, community-driven science was the most appropriate way to address the question.

D.5.6. Basin and Range National Monument BioBlitz 2021[334]

Sponsoring Agency and Office: Bureau of Land Management

Authority: Federal Land and Policy Management Act, 43 USC §1711.

Activity Summary: From June 4 to 6, 2021, approximately 100 BLM staff and volunteers collected photo and geospatial data of plants and animals in Basin and Range National Monument in Nevada. Participants recorded 1,728 observations and 406 species during the blitz using the iNaturalist application. The event included 11 federal, state, and other partners. Data were used to refine habitat models created by USGS, focus monitoring efforts, and to better inform future management of the area based on the best available science.

Advancement of Agency Mission: Knowing the distribution of plant and animal species within the area of the BioBlitz helps managers make more informed decisions based on the best available science. Maintaining a periodic and systematic inventory of public lands resources is a component of the Federal Land Policy and Management Act (FLPMA).

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[333] The website for Assessing the Health of Otter Creek Inner Harbor and Potential Pathways to Remediate Problems is accessible at https://thrivingearthexchange.org/project/mount-desert-me/.

[334] The website for Basin and Range National Monument BioBlitz 2021 is accessible at iNaturalist project page for the Bioblitz is located at: https://www.inaturalist.org/projects/basin-and-range-national-monument-bioblitz-2021.

Justification for Using Crowdsourcing and Citizen Science: BLM had entered into agreements with partners to inventory plant and animal resources within Basin and Range National Monument. These partnerships and the lack of existing inventory data led the BLM and the partners to plan a citizen science BioBlitz event to collect data, refine habitat models, and better inform the ongoing partnerships and projects.

D.5.7. Blotchy Bass Biosurveillance Initiative (B3i)[335]

Sponsoring Agency and Office: U.S. Geological Survey

Authority: Organic Act of 1879

Activity Summary: Blotchy bass syndrome (BBS) is a condition characterized by visible, variable, and discrete areas of hyperpigmentation on the external surface of black basses. Advances in sequencing technology and diagnostic capabilities have informed disease biosurveillance efforts, and subsequently led to the discovery that BBS is associated with viruses of the family Adomaviridae. The public is often aware of and interested in fish and wildlife diseases, particularly those that lead to changes in the appearance of animals or affect species of high recreational or commercial value like black basses. Crowdsourced data collection can be used to increase community engagement and buy-in, as well as expand geographical and temporal sampling coverage beyond realistic management agency resources. We opted to leverage crowdsourcing efforts including traditional solicitation as well as using smartphone applications and virtual fishing events. Multiple discrete, but overlapping efforts were undertaken starting in August of 2021. During March of 2022, state agency partners solicited reports of BBS via social media, requesting that anglers submit photos and catch location information. During the Summer and Fall of 2022 a virtual BioBlitz was conducted using the Angler's Atlas MyCatch smartphone application, incentivized with prizes awarded by Bass Pro Shops. The "Blotchy Bass Bonanza" citizen science effort was launched in July of 2022 and encompassed all freshwater waterbodies within the United States and Canada. Between the two efforts, data were submitted from 31 states, 6 Canadian provinces, as well as individual submissions from Mexico and Spain. Anglers submitted a total of 1,077 digital photos of individual fish with presumptive BBS for professional review. Based on MyCatch catch per effort metrics (0.763 bass/hour) and BBS prevalence (1.9%), we estimated the equivalent of 70,082 donated personnel hours by citizen scientist anglers with an estimated value of $2,120,666.

Advancement of Agency Mission: The Biological Threats and Invasive Species Research Program (BTRP) provides essential information, data, research, detection methodologies, management methods, and decision-support tools to help resource managers reduce the threat of invasive species and fish and wildlife disease. The B3i project was supported by BTRP to research the unquantified, emerging biological threat of blotchy bass syndrome. Data from this project will inform management agencies interested in preventing the spread of this disease, the cause of this condition, as well as the temporal and spatial distribution of this disease. Any trends in temporal variability will inform biological knowledge of the viral pathogen, and provide guidance for any future management actions. All data

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[335] The website for Blotchy Bass Biosurveillance Initiative (B3i) is accessible at https://www.usgs.gov/centers/eesc/science/investigating-blotchy-bass-syndrome-black-basses https://www.usgs.gov/centers/eesc/news/partnerships-encourage-public-assist-fish-disease-biosurveillance https://www.anglersatlas.com/event/602/blotchy-bass-bonanza-2022 https://www.usgs.gov/media/videos/2022-blotchy-bass-syndrome-biosurveillance-project https://www.anglersatlas.com/event/695/2023-blotchy-bass-bonanza-2023.

will be stored within the public-facing USGS maintained and supported data repository called Aquatic Disease and Pathogen database (AquaDePTH).

Justification for Using Crowdsourcing and Citizen Science: Blotchy bass syndrome is characterized by the presence of variable, discrete areas of hyperpigmented blotched on the external surface of black basses. This is a condition that has received increasing attention from anglers and resource managers during the past decade, and it is a frequent topic of discussion on angling websites and blogging platforms. Establishing image-based crowdsourced biosurveillance increases and augments geographical and temporal sampling coverage beyond realistic management agency resources, such that observations can still be vetted. Efforts using existing frameworks of smartphone apps and virtual fishing tournaments can increase community engagement, buy-in, and goodwill. The use of virtual or simulated fishing tournaments using smartphone apps is only projected to increase and provides a novel opportunity for broadscale data collection with low barriers to entry.

D.5.8. Bridging Local Outreach and Seismic Signal Monitoring (BLOSSM)[336]

Sponsoring Agency and Office: U.S. Geological Survey

Authority: Organic Act of 1879

Activity Summary: Raspberry Shake is a commercial product that started as a crowdfunding campaign and took off to become an amateur seismic network with global coverage. We present a novel use of the Raspberry Shake seismometers and its use in Bridging Local Outreach and Seismic Signal Monitoring (BLOSSM) projects. BLOSSM aims to provide resources to educational institutions and meaningful engagements with the public while supplementing earthquake monitoring efforts of regional seismic networks. We find great benefits in 1) using this approach on communities living in newly seismically active areas, where historical rates or felt-earthquakes have been low; 2) rapid deployments of inexpensive seismometers in sparsely or barely monitored regions; and 3) engaging students and teachers by developing lesson plans for K-12 grade levels. Examples of BLOSSM projects have sprouted in Oklahoma (2017), Hawai'i (2018), Guam (2020), and American Samoa (2022). The essence of BLOSSM is easily translatable to other types of volcano monitoring sensors (gas, photographs, videos, and infrasound). In recent years, publicly available data and technological advancements have given new momentum to citizen science initiatives. Critical scientific data gathered by specialized instrumentation using readily available off-the-shelf components, such as Raspberry Shake seismometers, can be used to empower youth in a problem-based learning approach during a summer-long course or weaved into teacher curricula during the normal school year. With guidance from USGS Hawaiian Volcano Observatory scientists, students essentially adopt the hazards mission of the USGS. Students not only aid in the volcano monitoring efforts on Hawai'i Island, but also (1) take ownership of their own learning, (2) increase their capacity in STEM, and (3) engage the local community and address its needs.

Advancement of Agency Mission: An example of this played out in the U.S. Territory of American Samoa. During late Summer of 2022, residents of the Manu'a (Ta'u, Ofu, and Olosega) Islands reported feeling an alarming number of local earthquakes to the NOAA National Weather Service-Weather Service Office (NWS-WSO) at Pago Pago. Residents of American Samoa typically do not feel local earthquakes, and the U.S. Territory does not have a local agency that monitors seismicity. It took a few days until the news of

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[336] The website for Bridging Local Outreach and Seismic Signal Monitoring (BLOSSM) is accessible at https://www.usgs.gov/news/volcano-watch-hvo-looking-install-seismographs-your-community.

a seismic uptick reached HVO, which has the responsibility of monitoring the volcanoes of American Samoa. Magmatic activity from Vailulu'u, an active undersea volcano 43 km east of Ta'u island, was suspected to be at unrest, which could lead to a possible underwater eruption. With the nearby Tonga eruption and subsequent tsunami that happened just a few months earlier, the local communities were tense, and having no monitoring equipment in-place meant that USGS could not formulate any sort of educated statement about the area with regards to what was happening. HVO sent six Raspberry Shake seismometers as an initial response. The same day that the instruments were deployed, HVO was able to determine that (1) the earthquakes were not coming from Vailulu'u and that (2) volcanic activity was not impending. Residents were empowered by their ability to access the real-time data through their mobile devices and engage each other and scientists during the crisis, allowing USGS to better serve the community and emergency managers as we monitored the dynamic situation.

Justification for Using Crowdsourcing and Citizen Science: The synergy between single board computers and the makerspace movement has placed viable scientific instruments into the hands of hobbyists and enthusiasts. Inexpensive technologies, like Raspberry Pi and numerous accessories that can attach to its General-Purpose Input/Output pins, have made seismic monitoring more accessible to a wider group of people outside of the seismological community. BLOSSM does not fit neatly within the CCS definition. We utilize the backbone of the amateur Raspberry Shake global seismograph network as a vehicle to engage with local communities. The Raspberry Shake software, web services, and forum is uniquely suited for ease of use. Users need not know technical details (e.g., network routing or instrument calibrations) to see scientifically meaningful data. Sensors are intended to be used in school and public learning environments (e.g., parks and museums).

D.5.9. Did You Feel It? (DYFI)[337]

Sponsoring Agency and Office: U.S. Geological Survey

Authority: Organic Act of 1879, Earthquake Hazards Reduction Act (National Earthquake Hazards Reduction Program (NEHRP), 42 USC 7701

Activity Summary: The U.S. Geological Survey (USGS) "Did You Feel It?" (DYFI) is an automated system for rapidly collecting macroseismic intensity data from Internet users' shaking and damage reports and generating intensity maps immediately following earthquakes. Although the collection and assignment of DYFI-based Macroseismic Intensity (MI) data depart from traditional assignments, they are made more quickly, provide more complete coverage at higher spatial resolution, offer citizen input and interaction, and allow data collection at rates and quantities that were not previously possible. These aspects of Internet-based data collection, in turn, allow for data analyses, graphics, and ways to communicate with the public, opportunities that were not feasible with traditional data collection approaches. DYFI decimal MI assignments are based on regression against traditional MI, and geocoding allows for spatial averaging; both strategies facilitate quantitative data analyses. The DYFI questionnaire can be found at: https://earthquake.usgs.gov/dyfi. The DYFI project is designed to gather information available about earthquakes from the people who experience them. By tapping an immense number of users online, DYFI can get a detailed characterization of what people were experiencing during the earthquake, the impacts of the earthquake, and the amount of damage it caused, beyond the scope of traditional information gathering techniques. Data input from users is

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[337] The website for Did You Feel It? (DYFI) is accessible at https://www.usgs.gov/tools/did-you-feel-it | https://earthquake.usgs.gov/data/dyfi | https://earthquake.usgs.gov/data/dyfi/summary-maps.php | https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=9310990e7ce84e3b8567109616b0944d.

immediately available on the website, and its interactive platform encourages users to gain a deeper understanding of earth sciences while they participate. The DYFI data are used to inform earthquake response and scientific studies about earthquake shaking and damage.

Advancement of Agency Mission: DYFI also allows for valuable positive interactions of the citizenry with a federal science agency. The widespread adoption of DYFI along with ShakeMap has facilitated the general acceptance of the very concept of shaking intensity, fundamentally improving our agency's ability to communicate both hazard and risk to the population. DYFI effectively confirms the importance of reporting and inculcating the public's understanding of intensity in addition to magnitude for a proper perspective of earthquake risk related decision-making. The vast amount of DYFI data allows for data-rich analyses of otherwise intractable seismological, sociological, and earthquake impact studies, like quantifying the shaking due to induced earthquakes, human response, and risk perception as well as relating recorded shaking metrics to macroseismic effects and attenuation of intensity with magnitude and distance.

Justification for Using Crowdsourcing and Citizen Science: DYFI is an ongoing citizen science endeavor. The DYFI project taps into a natural crowdsourcing and citizen science audience to report the shaking experienced at their location immediately after felt earthquakes. It is one of the most suitable and cost-effective uses of crowdsourcing and citizen science, since participants are eager to share their observations with the Federal Government, and USGS seismologists and scientists benefit from these citizen science data. Earthquake disaster managers and responders also benefit from the situational awareness provided by DYFI after significant earthquakes. Over the course of the operational DYFI system, USGS has received over 6.7 million responses, with typically over 300,000 individual responses per year. The greatest number of responses was over 140,000 in 2011 for the 5.9 magnitude earthquake in Mineral, VA.

D.5.10.   FLOW Permanence (FLOwPER)[338]

Sponsoring Agency and Office: U.S. Geological Survey

Authority: Organic Act of 1879

Activity Summary: The accurate mapping of streams and their streamflow conditions in terms of presence or absence of surface water is important to both understanding physical, chemical, and biological processes in streams and to managing land, water, and ecological resources. The FLOW PERmanence (FLOwPER) field form provides standardized data collection to map the presence of flow in streams and upload the input data to an ArcGIS database. These data can be used for multiple purposes, such as archiving where flowing water is present in forest planning units, informing modeling efforts of streamflow permanence, and providing information needed to update stream classifications across any spatial extent. FLOwPER uses the ArcGIS Online (AGOL) Survey123 platform, which operates on a variety of mobile devices, including those from agencies and personal mobile devices. FLOwPER is designed for seamless communication with ArcGIS online for easy uploading of collected observations into a publicly available master database (FLOwPER Database) that can include any geographic region. FLOwPER focuses on the rapid collection of a set of simple visual observations that can be recorded from a road over a stream or while standing on the bank of a stream. Use of FLOwPER requires a mobile

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[338] The website for FLOW Permanence (FLOwPER) is accessible at https://www.usgs.gov/center-news/flowper-user-s-guide-collection-flow-permanence-field-observations   https://doi.org/10.3133/ofr20201075 https://www.fs.usda.gov/research/pnw/products/dataandtools/tools/flowper-field-app.

device that can access the FLOwPER field form through the Survey123 app and an accurate Global Positioning System (GPS) antenna with a rated accuracy of 1 meter or less. With crowdsourced observations collected by many users of FLOwPER, it is possible to collect a large number of observations from a wide geographical range from all parts of the stream network at any time of the year. Although seasonal drying of streams is often of interest, FLOwPER can be used to evaluate patterns of flow permanence at any time of year, including times when stream networks are greatly expanded during wet cycles. To access FLOwPER, log in at https://arcg.is/0a4iGi0. Users must have an organizational AGOL account to request access.

Advancement of Agency Mission: The accurate mapping of streams and their streamflow conditions is important to the understanding of physical, chemical, and biological processes in streams and how to better manage land, water, and ecological resources. However, streamflow classifications across the Nation are not up-to-date. FLOwPER enables us to rapidly update streamflow classifications and streamflow conditions to advance the understanding of flow permanence. By crowdsourcing these observations from trusted and expert users that understand streamflow conditions, this dramatically increases the density and geographic extent in data sparse areas. FLOwPER data can also be used for multiple purposes, such as archiving where flowing water is present in forest planning units, informing modeling efforts of streamflow permanence, and providing information needed to update stream classifications across any spatial extent.

Justification for Using Crowdsourcing and Citizen Science: FLOwPER is designed to collect and classify streamflow conditions more efficiently and accurately in a quick and easy way. This flexible GIS mobile app standardizes the collection of field observations and leverages the advantages of cloud storage technology to support the spatio-temporal modeling required to characterize stream flow permanence of headwater streams. The FLOwPER mobile app enables us to crowdsource the collection of these field observations at a much larger scale, at a wider geographical range from all parts of the stream network, and at any time of the year. We target internal collaborators, partners, and cooperators to contribute to FLOwPER either opportunistically or as part of an existing study design, since they already are conducting field work in remote hard to access areas, have a high-precision GPS device, and have specialized knowledge of stream flow conditions.

D.5.11. Great Smoky Mountain National Park Historic Homesite Identification Project[339]

Sponsoring Agency and Office: National Park Service

Authority: NPS Organic Act

Activity Summary: The lands of Great Smoky Mountains National Park have been the home of people for countless generations. European immigrants and descendants date back to the 1790s, but few of their pre-20th century homesites have been identified. Researchers and historians invite the public to contribute historic photos and related documents that can reveal more about these residents. Data collected from the public is currently being compared to existing data and will then be used to verify the location of previously unrecorded homesites in the park. The goal is to locate the remaining 25% of the estimated 2,000 sites of residency in the park.

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[339] There was no website provided for Great Smoky Mountain National Park Historic Homesite Identification Project.

Advancement of Agency Mission: The results from this project will allow the Cultural Resource Branch to have a much more complete understanding of the extent of European habitation in Great Smoky Mountains National Park.

Justification for Using Crowdsourcing and Citizen Science: Much of the data needed for the project exists in public memories or is held by members of the descendent communities.

D.5.12. Greening STEM in McInnis Canyons National Conservation Area.[340]

Sponsoring Agency and Office: Bureau of Land Management

Authority: FLPMA

Activity Summary: Staff from BLM McInnis Canyons National Conservation Area identified an area of heavy Russian knapweed (an invasive plant) infestation along the Colorado River with biological control (Russian knapweed gall wasp) as a potential treatment method. In May of 2021, the BLM partnered with Colorado Canyons Association (CCA), a local non-profit friends group, the Palisade Insectary, and Central High School for a National Environmental Education Foundation (NEEF) supported Greening STEM project. As part of the project, students recorded data on invasive plant species density and vegetation and reported data to the BLM. Central High School students released gall wasps (biological control) in the infested area, completed an educational river trip, and performed vegetation monitoring with support from CCA, BLM, and the Palisade Insectary. This project provides hands-on, experiential learning for students, meets community goals of CCA, and provides consistent monitoring data about the Russian knapweed infestation and progress of biological controls for the BLM and Palisade Insectary.

Advancement of Agency Mission: The project provides outreach to local students and consistent data for biological controls of an invasive plant species, to support invasive plant management.

Justification for Using Crowdsourcing and Citizen Science: The benefits to the students are tremendous. It is a meaningful experience for them and a chance for them to see their classroom lectures put to use in a 'real world' situation. They also provide consistent and meaningful data to the BLM and Palisade Insectary and provide a compelling project and story for Colorado Canyons Association.

D.5.13. Increasing Community Resilience for Watershed Urbanization[341]

Sponsoring Agency and Office: National Park Service

Authority: NPS Organic Act

Activity Summary: The project seeks to develop and implement a community science water quality and geomorphology monitoring protocol. Community members will implement the protocol to collect baseline data to help track how urbanization and pollution impact local surface waters. At Congaree National Park (CONG), water quality is a major concern for fisheries and paddling. Chemical and biological monitoring are effective in monitoring stream health but require potentially expensive sensors and supplies as well as expertise. Stream geomorphology, on the other hand, provides an accessible visual metric that is—if calibrated correctly—very amenable to citizen science monitoring.

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[340] There was no website provided for Greening STEM in McInnis Canyons National Conservation Area..
[341] The website for Increasing Community Resilience for Watershed Urbanization is accessible at https://thrivingearthexchange.org/project/hopkins-sc/.

Stream geomorphology reflects how water, sediment, and organic matter balance with slope and width, surficial geology, soils, and vegetation to determine a river channel's form. Human disturbances such as urbanization, erosion, pollution, and land use can cause a stream channel to change its pattern, profile, and dimensions. These changes can further impact habitat quality, threats to public safety, and other ecological parameters. The South East Rural Community Outreach (SERCO), CONG Community Science Fellow Claudia Santiago, and other partners will facilitate a five-phase project to continue monitoring various sites that can serve as a benchmark for development impacts, community action needs, and management/restoration goals. Additionally, monitoring program results could encourage actions to improve water quality, support healthy freshwater fishing, facilitate further research and monitoring, and reduce potential public health risks at CONG. The project aims to frame the monitoring protocol by leveraging generational knowledge of the African American community and other historically excluded communities that have long resided in the area.

Advancement of Agency Mission: The project is advancing equitable access to the National Park Service and Congaree National Park (CONG)'s natural resources. It develops a place-based and culturally sensitive water quality monitoring program that encourages local African American communities to engage in stewardship of the park and promotes understanding of how urbanization and water pollution will affect local coastal plain streams. Stewardship and understanding/enjoyment of resources are the two halves of the NPS mission.

Justification for Using Crowdsourcing and Citizen Science: Water quality monitoring will become more important as Lower Richland continues to change from development of the Lower Richland Sanitary Sewer project, urbanization, and population growth. Having baseline water quality data to track potential future impacts is fundamental to monitoring. This project seeks to leverage a community-level and interdisciplinary approach to water quality monitoring informed by local decision-makers, resource users, community members, and scientists. The project aims to incorporate generational knowledge acquired over the last 400 years through the local African American experience to develop local framing and understanding of complex scientific perspectives. This approach allows for better knowledge of how urbanization and water pollution impact local surface waters than can be achieved by park staff alone.

D.5.14.   Indigenous Observation Network[342]

Sponsoring Agency and Office: U.S. Geological Survey

Authority: Organic Act of 1879

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[342] The website for Indigenous Observation Network is accessible at https://www.usgs.gov/centers/casc-sc/science/yukon-river-basin-indigenous-observation-network | https://www.sciencebase.gov/catalog/item/59efa6d0e4b0220bbd99b1b5 | https://www.yritwc.org/science | https://yukon.next.fieldscope.org | NSF Grant: Collaborative Research: Indigenous Observation Network 2.0: Impacts of Environmental Change on the Yukon and Kuskokwim Watersheds. https://www.nsf.gov/awardsearch/showAward?AWD_ID=1753397 | NSF Grant: The Yukon River Basin Indigenous Observation Network: Uniting Traditional Ecological Knowledge and Western Science to Address and Understand Water Resources in the Arctic https://www.nsf.gov/awardsearch/showAward?AWD_ID=1020417 | Schuster, P.F., and Maracle, K.B. (2010). Studies of climate change in the Yukon River Basin—Connecting community and science through a unique partnership: U.S. Geological Survey Fact Sheet 2010-3020, 4 p. https://doi.org/10.3133/fs20103020.

Activity Summary: The Indigenous Observation Network (ION) is a collaborative Community-Based Monitoring (CBM) program with both permafrost and water-quality monitoring components operating in the Yukon River Basin (YRB) of Alaska and Canada. ION is jointly facilitated by the Yukon River Inter-Tribal Watershed Council (YRITWC), an indigenous non-profit organization, and the U.S. Geological Survey (USGS), a federal agency. The YRB is the fourth largest drainage basin in North America encompassing 855,000 square kilometers in northwestern Canada and central Alaska and is essential to the ecosystems of the Bering and Chuckchi Seas. Water is also fundamental to the subsistence and culture of the 76 Tribes and First Nations that live in the YRB providing travel routes and sustenance in the form of drinking water, fish, wildlife, and vegetation. Despite the ecological and cultural significance of the YRB, the remote, often roadless, geography of sub-Arctic and Arctic Alaska and Canada make it difficult to collect scientific data in these locations and led to a lack of baseline data characterizing this system until recently. In response to community concerns about the quality of the Yukon River and a desire by USGS scientists to create a long-term water-quality database, the USGS and YRITWC collaborated to create ION in 2005. Surface water samples are collected by trained community technicians from Tribal Environmental Programs or First Nation Lands and Resources staff from over 35 Alaska Native Tribes and First Nations that reside along the Yukon River and/or one of the major tributaries. Samples are analyzed at USGS laboratories in Boulder, CO and results are disseminated to participating YRB communities and the general public.

Advancement of Agency Mission: The results of the ION have been used by federal agencies to better understand changing water chemistry in the Yukon River Basin. The ION data is publicly available online and our peers in the scientific community have also made use of the active layer data collected in collaboration with community members. ION data has informed important regional differences in geochemistry and active layer parameters linked to permafrost continuity and tributaries. Understanding these hydrological changes through annual trends and seasonal dynamics with spatial and temporal heterogeneity of the watershed has assisted the global effort to characterize arctic river fluxes and their relationship to the carbon cycle, weathering, and permafrost degradation to better understand the effects of climate change to inform climate adaption planning for indigenous communities in the Yukon River Basin.

Justification for Using Crowdsourcing and Citizen Science: ION is a Community-Based Monitoring program and a transboundary Indigenous initiative that aims to combine Western Science and Indigenous Knowledge to research, sustain, and protect the water and Indigenous people of the Yukon River Basin, who are facing the dramatic effects of global environmental change and resource development. ION is supported by a Memorandum of Understanding between USGS and YRITWC, a formal agreement to cooperate and engage in research that incorporates Indigenous culture, knowledge, and perspectives in conjunction with high-quality field, laboratory, and data analysis methods to develop and sustain a baseline water quality monitoring program using protocols and methods derived from the USGS. The community-based monitoring approach has strengthened data quality and credibility, trust and legitimacy, and the use of ION data in decision-making processes. ION leverages and expands upon long-term USGS hydrology and water quality monitoring efforts in some of the most remote locations within the U.S.

D.5.15.   Monitoring Bats along the Colorado River in Grand Canyon[343]

Sponsoring Agency and Office: U.S. Geological Survey

Authority: Organic Act of 1879, The Grand Canyon Protection Act of 1992 (Public Law 102-575)

Activity Summary: There are 24 species of bats known to Grand Canyon National Park, more than any other park unit. Despite this biodiversity, relatively little research has been conducted on bats within the national park, especially along the river corridor. We collaborate with river guides in Grand Canyon to record bat activity along the river using acoustic devices. Acoustic data collection is a passive and non-invasive (no handling bats) method for gathering data on bat diversity and abundance. The participants in this project also collect data on aquatic insects using light traps through a pre-existing community science project (see 'Aquatic Insect Monitoring in Grand Canyon'). Combining these two methods has provided insight on the relationship between bat activity, insect availability, and Glen Canyon Dam operations.

Advancement of Agency Mission: The USGS Southwest Biological Science Center provides science in support of adaptive management experimentation at Glen Canyon Dam. This project highlights the importance of the river to adjacent terrestrial systems and data collected from this project informs stakeholders of aquatic-terrestrial linkages in Grand Canyon.

Justification for Using Crowdsourcing and Citizen Science: This project was initiated as an extension of an extant community science project that has river guides sample aquatic insects in Grand Canyon using light traps (see 'Aquatic insect monitoring in Grand Canyon'). Collaborating with community scientists in Grand Canyon provides researchers access to remote river camps that are logistically challenging to access and sample. Combining acoustic recording of bats with light trapping for aquatic insects provides a unique opportunity to investigate bat foraging and aquatic-terrestrial linkages along the river corridor in Grand Canyon.

D.5.16.   Nonindigenous Aquatic Species (NAS)[344]

Sponsoring Agency and Office: U.S. Geological Survey

Authority: Organic Act of 1879, Nonindigenous Aquatic Nuisance Species Control and Prevention Act of 1990 (P.L. 101-646)

Activity Summary: The U.S. Geological Survey (USGS) Nonindigenous Aquatic Species (NAS) Program based at the USGS Wetland and Aquatic Research Center (WARC) monitors, analyzes, and records sightings of non-native (introduced) aquatic species throughout the United States. Nonindigenous aquatic species are member(s) (i.e., individual, group, or population) of a species that enters a body of water or aquatic ecosystem outside of its historic or native range. Most of the nonindigenous introductions are a result of human activities since the European colonization of North America. This includes not only species that arrived from outside of North America, which are commonly referred to

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[343] The website for Monitoring Bats along the Colorado River in Grand Canyon is accessible at https://www.usgs.gov/centers/southwest-biological-science-center/science/community-science-grand-canyon | https://www.usgs.gov/publications/insectivorous-bat-foraging-tracks-availability-aquatic-flies-diptera | https://doi.org/10.1002/jwmg.22414.

[344] The website for Nonindigenous Aquatic Species (NAS) is accessible at https://www.usgs.gov/centers/wetland-and-aquatic-research-center/science/nonindigenous-aquatic-species-nas-program | https://nas.er.usgs.gov | https://www.fws.gov/program/aquatic-nuisance-species-task-force/get-involved.

as exotics, but also species native to North America that have been introduced to drainages outside their native ranges within the country. The importance of studying nonindigenous organisms is to learn what effects they may have on the native organisms, the physical environment, and economically valuable ecosystems. The initiative to maintain scientific information on nationwide occurrences of non-native aquatic species began with the Aquatic Nuisance Species Task Force, a group created by Congress in 1990 to address the need for this type of information by natural resource managers. Since then, the NAS program has maintained the database as a clearinghouse of information for confirmed sightings of non-native aquatic species throughout the Nation. The program also produces email alerts, maps, summary graphs, publications, actionable tools, and other information products to support natural resource managers. The public plays a significant role in the invasive species issue by acting as "early detectors" of new invasions. People can report a non-native species through an online reporting form to accurately report the geographic coordinates using an online map and upload a photo for NAS program staff to verify the species identity.

Advancement of Agency Mission: Natural resource managers use the NAS database to determine where invasive species may occur, focus monitoring efforts, document range expansions, and inform management decisions. The U.S. Army Corps of Engineers used NAS to examine the risk of non-native species introduction across watershed connections to prioritize connections and identify potential threats to infrastructure projects that require monitoring. The USDA Forest Service used NAS to identify infested source waters, lowering the risk of unintentionally spreading non-native species while airdropping water drawn from natural sources (lakes and ponds) to fight fires. Federal, state, and NGO partners have used NAS information to prepare field guides, create watch lists, and look for range expansion of invasive species. NAS data and reports were used to make decisions about Lacey Act injurious listings. State planners used pathway analysis to determine where to direct public education as an intervention for decreasing new invasions.

Justification for Using Crowdsourcing and Citizen Science: The public plays a significant role in the invasive species issue by acting as "early detectors" of new invasions of nonindigenous species. Users can locate the waters where a nonindigenous species was seen, accurately report the geographic coordinates using an online map, and upload photographs for NAS program staff to verify the species' identity. This online tool has been very effective in reporting new invasions. A recent analysis of the NAS Alert System showed that approximately two-thirds of the alerts generated in the past five years have come from personal communication through this volunteer reporting mechanism. This public interface has provided some of the most important discoveries of new introductions including the aquarium moss balls infested with zebra mussels (Dreissena polymorpha) that, after the discovery, were found to be for sale in 46 U.S. states.

D.5.17.   North American Breeding Bird Survey (BBS)[345]

Sponsoring Agency and Office: U.S. Geological Survey

Authority: Organic Act of 1879

Activity Summary: The North American Breeding Bird Survey (BBS) is a long-term, large-scale, multinational avian monitoring program initiated in 1966 to track the status and trends of North

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[345] The website for North American Breeding Bird Survey (BBS) is accessible at https://www.usgs.gov/centers/eesc/science/north-american-breeding-bird-survey | https://www.pwrc.usgs.gov/BBS.

American bird populations. It provides the foundation for conservation planning and management of hundreds of North American bird species, keeping common birds common and helping fuel a $75 billion wildlife watching industry. Each spring over 3,000 citizen scientists, amateur birders, and professional biologists skilled in avian identification volunteer to collect data at over 150,000 BBS survey points across North America. The BBS uses standardized, statistically rigorous protocols to deliver scientifically credible measures of the status, trends, and environmental associations of North American birds, allowing us to better understand bird population changes and manage them. The USGS Eastern Ecological Science Center (EESC), Environment and Climate Change Canada (ECCC), and the Mexican National Commission for the Knowledge and Use of Biodiversity (CONABIO) jointly coordinate the program, which collects population data for over 700 North American bird species and provides reliable trend estimates for nearly 550 of those. The primary objective of the BBS is the estimation of bird population change but the data have many potential uses. More than 800 scientific articles using BBS information have been published, and researchers continue to find new applications of the data to inform emerging issues such as invasive species, climate change, chemical contaminants, and disease tracking. Federal and State agencies, and local resource planners throughout the U.S. and Canada make extensive use of BBS information to identify at-risk species, make wildlife management decisions, and facilitate science-based conservation and management of federal state trust species.

Advancement of Agency Mission: As the sole source of long-term, large-scale breeding season population change data for hundreds of bird species in North America, the BBS program fulfills, in part, the DOI mandate under the Migratory Bird Treaty Act to conserve and manage migratory bird species. BBS also provides the data needed to annually assess populations alerting wildlife management agencies to act before they reach critically low levels. BBS data provide an index of population abundance crucial to model-based conservation planning, and are used to estimate population trends and relative abundances at various geographic scales and time periods. The results are used extensively by federal and state land-use and conservation policy planners to assess bird species management priorities and inform national and regional avian conservation and management actions. Most recently, BBS data were used to document the loss of nearly 3 billion birds over the last 50 years, spurring the "Road to Recovery" conservation initiative.

Justification for Using Crowdsourcing and Citizen Science: Many factors have contributed to the success of the Breeding Bird Survey, but none has been more important than the participants who collect the data for this survey. Each year roughly 2,000 people perform surveys at more than 150,000 BBS survey points across North America. This predominantly volunteer workforce represents an elite and highly skilled cadre of birders whose experience rivals and often surpasses that of trained resource professionals. Assisting them is an additional thousand or so volunteers who take on the burden of such tasks as driving, collecting GPS coordinates, and recording tallies and stop descriptions in the field. An astounding 225,000 miles and 22,500+ hours are logged annually by the survey's dedicated workforce, earning the BBS a well-deserved reputation as the model for efficient large-scale wildlife monitoring.

D.5.18. Santa Rosa and San Jacinto Mountains National Monument Community Science Program[346]

Sponsoring Agency and Office: Bureau of Land Management

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[346] There was no website provided for Santa Rosa and San Jacinto Mountains National Monument Community Science Program.

Authority: Federal Land and Policy Management Act, 43 USC Chapter 35; Santa Rosa and San Jacinto Mountains National Monument Science Plan.

Activity Summary: The Santa Rosa and San Jacinto Mountains National Monument preserves nationally significant biological, cultural, recreational, geological, educational, and scientific values. The Monument is a diverse landscape that encompasses more than 280,000 acres which supports a rich assemblage of plants and animals. This biological hotspot is situated adjacent to the densely populated and growing, Coachella Valley in southern California. The science mission for the Monument is to identify, prioritize, and answer questions in a research and monitoring framework that will support management of the natural resources and recreational opportunities found therein and across the larger landscape. The Community Science program for the National Monument supports that mission with multiple biological studies taking place throughout the year, including many on-going research endeavors. Projects include water resource surveys, species inventories and habitat monitoring, as well as drought/climate change studies which vary by season. Species of interest include special status species such as the Mojave Desert tortoise (Gopherus agassizii), Monarch butterfly (Danaus plexippus), Coachella Valley milkvetch (Astragalus lentiginosus var. coachellae), and Peninsular bighorn sheep (Ovis canadensis nelsoni), as well as some general species such as creosote bush (Larrea tridentate), desert spiny lizard (Sceloporus magister), desert agave (Agave deserti) and Pinyon jay (Gymnorhinus cyanocephalus). Accomplishments for the community science program include monitoring of over 200 acres of habitat and hundreds of species inventoried on an annual basis. Staff and volunteers have made monumental scientific discoveries through the program including finding a rare white color morph of the federally endangered Coachella Valley milkvetch and gathering baseline data on a "new" population of Mojave Desert tortoise in the Santa Rosa Mountains. BioBlitz programs have recorded over 2,700 species and new species are documented each quarter during annual Winter, Spring, Summer and Fall bioblitz events

Advancement of Agency Mission: As part of the BLM's National Conservation Lands, the Monument created a science plan that encourages science within the Monument, effects positive change in managing at the landscape level, and promotes communications about science and cooperative conservation among other partners that manage lands within the Monument's boundary. This plan was approved in 2016 by the BLM and US Forest Service and has been the catalyst for carrying out this community science program. Community Science implementation has informed management of changes in resource conditions from climate change and increased drought conditions, with more drastic effects seen in the hotter and drier Santa Rosa Mountains. The science has shifted management focus to habitat restoration of riparian habitats in the Santa Rosa Mountains, as well as eradication of invasive species at natural water sources.

Justification for Using Crowdsourcing and Citizen Science: The Monument Science Plan proposed a monitoring program be implemented using citizen scientists (AKA, community scientists), such as those from Friends of the Desert Mountains, working alongside agency/university biologists. Community science has been used since 2012 and was extremely successful and allowed the Monument to meet its research needs, even with limited staff capacity. Since that time, the Community Science program has grown to be one of the most popular volunteer programs offered in support of the Monument. The science mission for the Monument is to identify, prioritize, and answer questions that will support management of the natural resources and recreational opportunities found therein and across the larger landscape. Investment in a strong community science program sustains research efforts through staff shortages and contributes data to ensure adaptive management.

D.5.19. The National Map Corps (TNMCorps)[347]

Sponsoring Agency and Office: U.S. Geological Survey

Authority: Organic Act of 1879

Activity Summary: The National Map Corps (TNMCorps) is an online crowdsourcing mapping project that began in 2012 as part of the U.S. Geological Survey (USGS) National Geospatial Program's The National Map, which collaboratively improves and delivers topographic information for the Nation. The National Map is free to the public and the government, and its uses range from disaster planning and emergency response to scientific analysis and recreation. The USGS National Geospatial Program (NGP) is currently pursuing a two-pronged approach for acquiring and maintaining structures data (e.g., data on schools, hospitals, post offices, fire stations, cemeteries, and other important public buildings). Where available, the Program is seeking authoritative national sources. To fill the gaps and improve the completeness, currency, and accuracy of the structures data, NGP's strategy is to deploy TNMCorps in using new technologies and Internet services to enable members of the public to produce volunteered geographic information (VGI) that will update and enhance the datasets. The use of The National Map Corps encourages citizen participation in volunteer map data collection activities and has resulted in more complete, current, and accurate (position and attributes) national datasets in The National Map. Volunteers earn virtual badges for participating and are recognized for their contributions (with permission) via the USGS and The National Map social media accounts. The TNMCorps volunteers collect and improve structures data in all 50 States, Puerto Rico, and the U.S. Virgin Islands providing many benefits to the Program, its users, and the Nation.

Advancement of Agency Mission: The mission of the USGS National Geospatial Program (NGP) is to organize, maintain, publish, and disseminate the geospatial baseline of the Nation's topography, natural landscape, and built environment through The National Map, which consists of basic geospatial information provided as a variety of mapping products and services. The use of The National Map Corps and Volunteered Geographic Information (VGI) has resulted in more complete and consistent national datasets in The National Map with improved positional and attribute accuracy. The use of The National Map Corps encourages citizen participation in volunteer map data collection activities and has resulted in more complete, current, and accurate (position and attributes) national datasets in The National Map, which has many uses ranging from disaster planning and emergency response to scientific analysis and recreation.

Justification for Using Crowdsourcing and Citizen Science: The use of The National Map Corps encourages citizen participation in volunteer map data collection activities. Volunteer participation improves government efficiency, public access to data, and data quality. Participation in The National Map Corps is easy and completely voluntary, raises geographic awareness, and improves users' skills in using web-based tools. Developing more complete and current structures data in The National Map may improve emergency preparedness and response. The National Map Corps benefits the agency and the participants by providing opportunities for citizen participation in USGS science as well as creating opportunities for collaboration with other Federal agencies and partners. Status maps of The National Map Corps volunteer contributions are available at: https://www.usgs.gov/core-science-systems/ngp/tnm-corps/volunteer-contributions.

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[347] The website for The National Map Corps (TNMCorps) is accessible at https://www.usgs.gov/core-science-systems/ngp/tnm-corps | https://edits.nationalmap.gov/tnmcorps .

D.6.   National Aeronautics and Space Administration (NASA)

D.6.1. Feature Hunter[348]

Sponsoring Agency and Office: Human Exploration and Operations Mission Directorate

Authority: Unknown

Activity Summary: Feature Hunter is a web application that asks citizen scientists to identify various landforms within astronaut photography. The landforms include islands, volcanoes, glaciers, rivers, lakes, and other features of interest within the photographs. Citizen scientists choose a category to work through and then are presented with images. They are then asked whether that feature category is present within the image ('Is there an island in this picture?'). If they choose 'yes' then they are asked to draw a box around the extent of the feature and then submit the identification. This identification and associated bounding box is then added to our training data set used to improve out landform identification machine learning models. Those models are used to improve the search-ability of the Gateway to Astronaut Photography of Earth database which contains more than four million photographs of Earth taken by astronauts across all human spaceflight missions. These image labels increase the ability of researchers, educators, and the general public to find the images they need.

Advancement of Agency Mission: Feature Hunter assists in producing training data to improve our machine learning models used to enhance our ISS Crew Earth Observations image collection. These machine learning models enable the detection of various landforms, such as islands, within our more than four million astronaut images of Earth. By identifying these features we are able to provide a more robust capability to search through our image collection, enabling a more comprehensive data set for researchers and educators. Feature Hunter is one way we continue to expand our training data set through the help of citizen scientists.

Justification for Using Crowdsourcing and Citizen Science: The generation of machine learning training data lends itself well to the use of citizen scientists (e.g., image captchas). The Gateway to Astronaut Photography of Earth is constantly growing with the addition of hundreds of thousands of new images every year and the model training data needs to be continually updated to perform well. We experience very high public engagement with our photography and harnessing that interest to promote data enhancement has been successful for our group.

D.6.2. GLOBE Program[349]

Sponsoring Agency and Office: Science Mission Directorate

Authority: NA

Activity Summary: The Global Learning and Observations to Benefit the Environment (GLOBE) Program is an international science and education program that provides students and the public worldwide with the opportunity to participate in data collection and the scientific process and contribute meaningfully to our understanding of the Earth system and global environment. Announced by the U.S. Government on Earth Day in 1994, GLOBE launched its worldwide implementation in 1995. GLOBE

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[348]   The   website   for   Feature   Hunter   is   accessible   at https://eol.jsc.nasa.gov/BeyondThePhotography/FeatureHunter/.

[349] The website for GLOBE Program is accessible at https://www.globe.gov.

Observer is the GLOBE program's app; citizen scientists in in GLOBE countries can also download the app and take observations for a subset of GLOBE protocols and contribute to the GLOBE community. GLOBE is sponsored by NASA and supported by the National Science Foundation (NSF), National Oceanic and Atmospheric Administration (NOAA) and U.S. Department of State.

Advancement of Agency Mission: GLOBE contributes to NASA's strategic goal to expand human knowledge through new scientific discoveries, and specifically the strategic objective that includes understanding the Earth. GLOBE also contributes to the strategic goal to address national challenges and catalyze economic growth, specifically the strategic objective to inspire and engage the public in aeronautics, space, and science.

Justification for Using Crowdsourcing and Citizen Science: Citizen Science and crowdsourcing provide a practical and efficient means to collect local observations of the Earth system globally and over long time periods. GLOBE also engages students and teachers as a way for them to learn more about their own environment (local, regional, and global).

D.6.3. NASA AI4Mars[350]

Sponsoring Agency and Office: JPL's internal funding

Authority: Unknown

Activity Summary: AI4Mars is a crowdsourcing project to collect terrain labels on Mars rover images taken by Spirit, Opportunity, Curiosity, and Perseverance for the purpose of training a deep learning model to automatically classify the terrain. The participants are presented with a series of Mars rover images and asked to produce annotations on four types of terrain: sand, soil, bedrock, big rocks.

Advancement of Agency Mission: The AI4Mars crowdsourcing project trained the terrain classifier for Martian terrains using rover images to elevate the level of safety of future rover autonomy.

Justification for Using Crowdsourcing and Citizen Science: Deep learning requires a significant volume of labeled data (typically >100K) which requires the participation of a substantial number of people. CCS was the right platform for this goal.

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[350] The website for NASA AI4Mars is accessible at https://www.zooniverse.org/projects/hiro-ono/ai4mars.

Appendix E.Surveys Used to Collect Information on FY21–22 Federal Prize Competitions and Challenges and Crowdsourcing and Citizen Science Activities

This Appendix contains the two surveys used to collect information on Federal Prize Challenges and Crowdsourcing and Citizen Science activities conducted in FY21-22. Please note the survey took advantage of the online survey platform's display logic that allowed specific subsequent questions to display depending upon the respondent's previous responses. Information within the brackets (either "[ ]" or "{ }") indicate where fields were auto-populated with existing information (e.g., title of activity) to personalize the surveys.

Prizes FY21-22 Survey

FY2021–22 Reporting on Federal Prize Competitions

This survey is associated with **(activity_title)**.

Submission details: By no later than **December 21, 2022**, please report to the White House Office of Science and Technology Policy (OSTP) all prize competitions your agency carried out (i.e., launched, ongoing, or completed) during Fiscal Years 2021 and 2022 under Section 24 (15 U.S.C. 3719) of the Stevenson-Wydler Technology Innovation Act of 1980 (commonly referred to as the COMPETES authority). Please note that the Implementation of Federal Prize and Citizen Science Authority Fiscal Years 2021-22 Report will be submitted to Congress and made publicly available.

Reporting information for prize competitions conducted or otherwise supported under other authorities provides visibility for the effort, and can be valuable for the overall prize competitions community, as well as the public, to see how competitions can be used to advance agency missions. Agencies are highly encouraged, but not required, to complete this survey for prize competitions conducted under authorities other than COMPETES during this reporting period.

OSTP is leading the data collection for the final consolidated report. The Institute for Defense Analyses (IDA) Science and Technology Policy Institute (STPI) is a Federally funded research and development center (FFRDC) created by Congress to provide the OSTP with technical support and analysis. STPI is working with OSTP to support this data collection and analysis effort.

Required Reporting Information: Only information on activities entered via this online survey tool will appear in the biennial report.

Please complete the following survey **once for each prize competition or challenge** that is launched, ongoing, or completed under Section 24 during this reporting period. Prize competitions run under the broader umbrella of Grand Challenge programs supporting a variety of activities should be

reported individually. For prize competitions in which multiple Federal agencies are involved, reporting should be completed only once by the lead agency.

If applicable, please remember to contact your agency lead or coordinator as they will be the first step in this review and clearance process at your agency. If you are unsure who your agency lead or coordinator may be, please contact STPI at prizes@ida.org.   Please note that this survey employs display logic and the questions presented will be determined by the answer choices you select.   **If you have any questions or are experiencing technical issues please contact STPI at: prizes@ida.org**

Definitions: The following terms are defined as follows:

Participant—an individual or other entity (e.g., a team) that participated in a prize competition. Does not include other contributors like activity leaders, managers, or reviewers.

National Health Crisis or Emergency – a significant outbreak of an infectious disease, disorder, or similar event at the national level, as designated by the Department of Health and Human Services (HHS). List of current health crises available here: https://aspr.hhs.gov/legal/PHE/Pages/default.aspx

 Active Partner – an organization, entity, or community that directly contributed to the design or execution of the current activity by sharing their material or intellectual resources.

 Organization – as pertaining to the participants in an activity: includes businesses, companies, associations, or other entities typically consisting of more than one individual.

End of Block: Prizes intro

Start of Block: Agency Information

Agency-Level Data Collection

Welcome! This is the data collection survey for the following initiative: (activity_title).

 This section contains information related to your agency and its administration of prizes.

If you are the agency point of contact, please fill out this section before forwarding on this link to the (activity_title) point of contact. If you do not have an agency point of contact, please fill this section out to the best of your knowledge.

You will receive a warning when this section is coming to a close. You will not be able to come back to

this section once you pass that point, so please ensure your responses are what you would like to submit before moving on.

Primary point of contact within your agency for (activity_title) (response required).

   ◯ First name _____

   ◯ Last name _____

   ◯ Email address _____

   ◯ Phone number _____

Status FY21 - Please select the status of (activity_title) during FY21 (select all that apply) (response required).

   ☐   Launched

   ☐   Ongoing

   ☐   Completed

   ☐   No activity occurred during FY21

Status FY22 - Please select the status of (activity_title) during FY22 (select all that apply) (response required).

☐   Launched

☐   Ongoing

☐   Completed

☐   No activity occurred during FY22

Authority - Please select the authority under which (activity_title) was conducted (response required).

○ America COMPETES Reauthorization Act of 2010

○ Other authority (please specify) _____

○ Unknown

Provide name of sponsoring agency and office (if your office or component is not listed please select "other") (response required).

Agency

Office or component

▼ Administrative Conference of the United States ... World War I Centennial Commission ~ Other

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If you selected "other" as an office or component please enter the name here.

○ Office or component _____

✳

Please comment on future agency plans for prize competitions for the next two fiscal years (FY23 and FY24) (If activities are not yet planned please respond with "N/A") (max ~200 words).

_____

_____

_____

_____

_____

To the best of your ability, please select which practices were used to support (activity_title) (select all that apply).

☐   My office or agency has policy or guidance supporting the use of prize competitions and challenges

☐   My office or agency uses contract vehicle(s) to procure products and/or services for prize competitions and challenges

☐   My office or agency uses internal communication tools to support prizes competitions and challenges

☐   My office or agency carries out coordinated external communications or maintains a webpage for prizes competitions and challenges

☐   My office or agency has a dedicated, central prize competition and challenge coordinator

☐   My office or agency has identified a prize competition and challenge POC (not dedicated full-time to prize competitions and challenges)

☐   My office or agency has a distributed network or community of prize competition and challenge managers and/or POCs within the agency

☐   My office or agency provides centralized training and design support for staff conducting prize competitions and challenges

☐   My office or agency has developed or is in the process of developing centers for interagency challenges in specific topics related to prize competitions and challenges

☐   My office or agency has a distributed network or community of project managers and/or resource people within the agency with expertise in prize competitions and challenges

☐   Other (please specify): _____

☐   ⊗ None or Unknown

Page Break

This marks the end of the agency-level information. By clicking next you advance the survey onto activity-level information and will not be able to go back to this section.

Prize-level data collection for (activity_title).

Welcome! This is the data collection survey for the following initiative: (activity_title).

As the activity point of contact, please fill out this section but **DO NOT PRESS SUBMIT** until you have cleared your response through your agency's clearance process, if applicable. If you have an agency point of contact, make sure to let them know when you have finished inputting your program information so they may review your responses and submit the form.

You will receive a warning when this section is coming to a close.

✱

Please provide a summary of (activity_title) suitable for broad, public dissemination. This summary may be included in the formal report to Congress as, for example, a case study (max 300 words) (response required).

_____

_____

_____

_____

_____

Link - Please provide a URL to the homepage for (activity_title), if available. You may enter more than one, if appropriate. If no URL exists, please answer "N/A."

_____

Please indicate whether (activity_title) was designed and implemented in response to a national health crisis or emergency.

○ Yes

○ No

Please indicate whether this activity was implemented as part of a coordinated response to said national health crisis or emergency.

○ Yes

○ No

Please describe briefly how this activity supported the larger, coordinated effort. (max 200 words).

_____

_____

_____

_____

_____

Page Break

Please provide the following information, if available, for (activity_title). Please note that dates should be entered in the following format mm/dd/yyyy.

	Submission dates		Submissions
	Open date	Close date	Number of submissions
(activity_title)			

Please provide the following information about (activity_title).

	Prize Purse	Award Information		Announcement Date
	Total prize purse for awards given out ($)	Total number of awards available	Total number of awards given out	Date winners were announced (mm/dd/yyyy)
(activity_title)				

⤭

Please indicate the type(s) of submissions sought by (activity_title) (select all that apply).

☐   Proposal or concept

☐   Prototype device or object

☐   Software or computer code

☐   Business or commercial development plan

☐   Creative media (e.g., images, videos, podcasts, logos)

☐   Analysis or visualization of data

☐   Other (please specify) _____

✳

Please provide a description of the submission(s) sought by (activity_title) (max of 150 words).

_____

_____

_____

_____

_____

End of Block: Activity Information 1

Start of Block: Activity Information 2

Please indicate whether the participants in (activity_title) were organizations or individual persons.

☐ Organizations

☐ Individuals

☐ Other _____

Please indicate whether the participants in (activity_title) were team-based or individual members. If some submissions come from teams and others from individuals, please select team-based.

○ Participants were team-based

○ Participants were individual members

Please provide a best estimate of the total number of individuals participating in each fiscal year.

○ FY21 _____

○ FY22 _____

Please indicate the best estimate of the total number of teams participating in each fiscal year.

○ FY21 _____

○ FY22 _____

If during the course of (activity_title) there was a specific effort to engage any of the below groups, please select which group(s) or identities these effort(s) were designed to reach:

- ⊗ No specific intended group
- ☐ Racial group
- ☐ Language group
- ☐ Sexual orientation
- ☐ Gender identity
- ☐ Socioeconomic status
- ☐ Veteran status
- ☐ Disability status
- ☐ Educational level
- ☐ Age
- ☐ Geographic area (e.g. urban/rural)
- ☐ Other (please specify): _____

✳

You indicated that you made a specific effort to engage certain group(s). Please describe the effort(s) you made to engage these group(s) (max 250 words).

_____

_____

_____

_____

_____

If during the course of (activity_title) there was a specific effort to engage any of the below company types, please select which company type(s) these effort(s) were designed to reach:

- ⊗ No specific intended type
- Minority-owned businesses
- Women-owned businesses
- Veteran-owned businesses
- LGBT-owned businesses
- Native American-owned businesses
- Small businesses
- Large businesses
- Rural businesses
- Urban businesses
- HUBZone businesses
- Other _____

✳

You indicated that you made a specific effort to engage certain businesses. Please describe the effort(s) you made to engage these businesses (max 250 words).

_____

_____

_____

_____

_____

⤭

Please select which of the following methods were used by the agency to publicize (activity_title), mobilize potential participants, and/or ensure high quality submissions (select all that apply).

☐ Social media (e.g., Twitter, Facebook)

☐ Email (e.g., listservs)

☐ Press release

☐ Live event(s) prior to the competition

☐ Live video streaming announcement

☐ Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

☐ Publicity efforts from vendors/contractors

☐ Posted on challenge.gov

☐ Other (please specify): _____

✳

Please describe the method(s) used to evaluate submissions to (activity_title) and to select winners. If appropriate, please indicate whether judges were internal-to-agency, cross-agency, external, or a mix (max 150 words).

_____

_____

_____

_____

_____

Please indicate the types of goals (activity_title) achieved (select all that apply).

☐   Improve a process/procedure/service carried out by the sponsoring agency

☐   Generate innovative ideas/designs/concepts (ideation)

☐   Develop/demonstrate technology (hardware or software)

☐   Education/training

☐   Outreach/information dissemination

☐   Launch the use of an enterprise/promote commercialization (including technology transfer)

☐   Build or strengthen a community

☐   Gather community/local/ ideas, solutions, and innovation

☐   Scale up the use of an enterprise/promote commercialization (including technology transfer)

☐   Scale up a community/locally relevant solution

☐   Launch a community/locally relevant solution

☐   Other (please specify) _____

*

Please describe the problem or opportunity (activity_title) is/was designed to address (max 150 words).

_____

_____

_____

_____

_____

Please describe the specific ways in which the results of (activity_title) have been or will be used by the agency to advance its mission (max 150 words).

_____

_____

_____

_____

_____

Please indicate why a prize competition was the method chosen to achieve the activity's goals (select all that apply).

- ☐ Activity required diverse expertise or interdisciplinary collaboration

- ☐ Sought diverse and/or innovative solutions

- ☐ Incentivize a larger number of submissions

- ☐ Flexibility to implement project design and achieve project goals

- ☐ Permitted cost and resource sharing with Federal and/or non-Federal partners

- ☐ Develop solutions in a quick timeframe

- ☐ Most cost-effective approach

- ☐ Low risk approach and/or pay-for-performance structure

- ☐ Less burdensome to design and execute than alternatives

- ☐ Identify and work with new innovators

- ☐ Engage a specific community

- ☐ Target audience could not have been reached through traditional mechanisms

- ☐ Promote awareness of a specific topic or agency research area

- ☐ Previous success with a prize competition

- ☐ Required by executive policy or congressional legislation

- ☐ Other (please specify): _____

✳

If (activity_title) was designed to advance diversity, equity, inclusion and accessibility, please describe specific ways in which it accomplished this (max 250 words).

_____

_____

_____

_____

_____

End of Block: Activity Information 3

Start of Block: Activity Information 4

Please indicate how agency funds were used in support of (activity_title) for each fiscal year (please select all that apply).

	FY21	FY22
Prize purse (monetary award)	☐	☐
Non-monetary award(s)	☐	☐
Federal personnel (FTE)	☐	☐
Purchase of consumable materials	☐	☐
Purchase or rental of equipment	☐	☐
Transportation of participants	☐	☐
Publicity/advertising/outreach/communications	☐	☐
Web portal/app development and support	☐	☐
Database development	☐	☐
Software development	☐	☐
Data entry/analysis	☐	☐
Discovery and design support	☐	☐
Operations or administrative support	☐	☐
Solution acceleration	☐	☐

Other (please specify): ☐ ☐

✳

Please provide a detailed description of how agency funds were used in support of (activity_title) (do not include a description of the prize purse or non-monetary awards) (max 300 words).

_____

_____

_____

_____

_____

Please provide a best estimate of the dollar amount the agency used in support of (activity_title) (do not include prize purse funding or the cost of FTE staffing).

○ FY21 _____

○ FY22 _____

Please provide the number of Federal personnel who contributed to (activity_title).

○ FY21 _____

○ FY22 _____

Please indicate the extent of the contributions of these personnel.

☐   Federal personnel contribute to (activity_title) part-time, in addition to primary responsibilities

☐   The design and implementation of (activity_title) is a primary responsibility of Federal personnel

☐   Federal personnel contribute to (activity_title) full-time

☐   Other arrangement, please describe
_____

Please provide the total amount of prize purse offered and awarded for each fiscal year (please write in "N/A" if not applicable).

	Total prize purse offered ($)	Total prize purse awarded ($)
FY21		
FY22		

Please indicate the non-monetary incentives that were offered to participants. Please write in "N/A" if no non-monetary incentives were offered (max 300 words).

- ☐ Certificate, trophy, or plaque

- ☐ Education or training opportunities

- ☐ Feedback from subject matter experts

- ☐ Invitation to visit agency facility

- ☐ Mentorship or networking opportunities

- ☐ Opportunity or invitation to publicly present solution

- ☐ Public recognition (e.g., agency website or social media, press release, award event)

- ☐ Recreation event

- ☐ Access to facilities or research infrastructure/devices

- ☐ Access to technical support or acceleration services (including vouchers for technical support)

- ☐ Other (please specify) _____

Please indicate how many active partners were involved in (activity_title).

    ○ 0 partners

    ○ 1 partner

    ○ 2 partners

    ○ 3 partners

    ○ 4 partners

    ○ 5 partners

    ○ >5 partners (If selected, we will contact you for information on additional partners)

Please provide the name for each active partner that was involved in (activity_title).

    ○ Partner 1 _____

    ○ Partner 2 _____

    ○ Partner 3 _____

    ○ Partner 4 _____

    ○ Partner 5 _____

X→

Please provide the following information for each partner that was involved in (activity_title).

	Federal Agency or Office	State or Local Government	Academic Institution	Nonprofit Organization (excluding Academic Institutions)	Private Industry	Other
Partner 1	○	○	○	○	○	○
Partner 2	○	○	○	○	○	○
Partner 3	○	○	○	○	○	○
Partner 4	○	○	○	○	○	○
Partner 5	○	○	○	○	○	○

X→

Please indicate which FY each partner provided contributions to (activity_title) (select all that apply).

	FY21	FY22
Partner 1	☐	☐
Partner 2	☐	☐
Partner 3	☐	☐
Partner 4	☐	☐
Partner 5	☐	☐

X→

Provide a best estimate of monetary value of each partner's contribution by FY.

	FY21	FY22
Partner 1		
Partner 2		
Partner 3		
Partner 4		
Partner 5		

Please indicate the type(s) of contributions provided by each partner for (activity_title) (please select all that apply).

	Partner 1	Partner 2	Partner 3	Partner 4	Partner 5
Prize purse (monetary award)	☐	☐	☐	☐	☐
Non-monetary award(s)	☐	☐	☐	☐	☐
Purchase of consumable materials	☐	☐	☐	☐	☐
Purchase or rental of equipment	☐	☐	☐	☐	☐
Transportation of participants	☐	☐	☐	☐	☐
Publicity/advertising/outreach/communications	☐	☐	☐	☐	☐
Web portal/app development and support	☐	☐	☐	☐	☐
Database development	☐	☐	☐	☐	☐
Software development	☐	☐	☐	☐	☐
Data entry/analysis	☐	☐	☐	☐	☐
Discovery and design support	☐	☐	☐	☐	☐
Operations or administrative support	☐	☐	☐	☐	☐
Solution acceleration	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐

Please indicate what other resources, if any, were provided by each partner to support (activity_title). If no other resources were provided, please enter "None."

- ○ Partner 1 _____
- ○ Partner 2 _____
- ○ Partner 3 _____
- ○ Partner 4 _____
- ○ Partner 5 _____

Do you collect data on the individuals or organizations who participated in (activity_title)?

- ○ Yes, we collect data on participants
- ○ No, we do not collect data on participants
- ○ Not applicable

What type of data did you collect? (e.g., participant demographics, engagement)

_____

_____

_____

_____

_____

*

Were there any barriers to data collection? If so, please describe the barriers and how they limited the data collection (max 250 words).

_____

_____

_____

_____

_____

If the data collected is publicly available, please post the URL in the field below.

○ Data URL _____

Did you evaluate (activity_title) in terms of its impact, stated goals, or participant engagement?

○ Yes, we evaluated our prize

○ No, we have not evaluated our prize

*

Please describe how you evaluated (activity_title) and what you found (max 250 words).

_____

_____

_____

_____

_____

If a report on the evaluation of (activity_title) is publicly available, please post the URL in the field below.

_____

End of Block: Activity Information 6

Start of Block: End of Survey

This is the end of the survey. By clicking the "next page" button below you will have an opportunity to review your responses and print or save/export a PDF of your responses for any approval process you may need to execute at your agency prior to final submission to STPI.

DO NOT PRESS SUBMIT UNLESS YOU ARE AN AGENCY POINT OF CONTACT OR YOUR SUBMISSION HAS BEEN REVIEWED AND APPROVED BY THE APPROPRIATE AGENCY CHANNELS.

End of Block: End of Survey

CCS FY21-22 Survey

FY21–22 Reporting on Crowdsourcing and Citizen Science

This data collection survey is associated with: (activity_title).

Submission details: By no later than **December 21, 2022**, please report to the White House Office of Science and Technology Policy (OSTP) all crowdsourcing and citizen science (CCS) activities the agency conducted during Fiscal Years 2021 and 2022 under the Crowdsourcing and Citizen Science Act. Please note that the Implementation of Federal Prize and Citizen Science Authority Fiscal Years 2021-22 Report will be submitted to Congress and made publicly available.

Reporting information for crowdsourcing and citizen science activities conducted or otherwise supported under other authorities provides visibility for the effort, and can be valuable for the overall Federal CCS community, as well as the public, to understand how CCS activities can be used to advance agency missions. Agencies are highly encouraged, but not required, to complete this survey for all Federal CCS activities conducted under authorities, including those other than through the authority of the Crowdsourcing and Citizen Science Act during this reporting period.

Background: The Crowdsourcing and Citizen Science Act (15 U.S.C. 3724) requires all crowdsourcing and citizen science activities carried out under this authority to be included as a component of the biennial report on Federal Prizes and Challenges, specified under Section 24 (15 U.S.C. 3719) of the Stevenson-Wydler Technology Innovation Act of 1980 (commonly referred to as the COMPETES authority).

OSTP is leading the data collection for the final consolidated report. The Institute for Defense Analyses (IDA) Science and Technology Policy Institute (STPI) is a Federally funded research and development center (FFRDC) created by Congress to provide the OSTP with technical support and analysis. STPI is working with OSTP to support this data collection and analysis effort.

Required Reporting Information: Only information on activities entered via this online survey tool will appear in the biennial report.

Please complete the following survey **once for each CCS project** that is *launched, ongoing, or completed* under the Crowdsourcing and Citizen Science Act during this reporting period. For CCS

activities in which multiple Federal agencies are involved, reporting should be completed only once by the lead agency.

If applicable, please remember to contact your agency lead or coordinator **as they will be the first step in this review** and clearance process at your agency. If you are unsure who your agency lead or coordinator may be, please contact STPI at citizenscience@ida.org. Please note that this survey employs display logic and the questions presented will be determined by the answer choices you select.

If you have any questions or are experiencing technical issues please contact STPI at: citizenscience@ida.org

Definitions: The following terms and definitions are defined as follows:

Citizen science—a form of open collaboration in which individuals or organizations participate voluntarily in the scientific process in various ways, including— Enabling the formulation of research questions; Creating and refining project design; Conducting scientific experiments; Collecting and analyzing data; Interpreting the results of data; Developing technologies and applications; Making discoveries; and Solving problems.

Crowdsourcing—a method to obtain needed services, ideas, or content by soliciting voluntary contributions from a group of individuals or organizations, especially from an online community.

Participant—an individual or other entity (e.g., a team) that volunteered in a crowdsourcing or citizen science project.

National Health Crisis or Emergency – a significant outbreak of an infectious disease, disorder, or similar event at the national level, as designated by the Department of Health and Human Services (HHS). List of current health crises available here: https://aspr.hhs.gov/legal/PHE/Pages/default.aspx

Active Partner – an organization, entity, or community that directly contributed to the design or execution of the current activity by sharing their material or intellectual resources.

Agency – a cabinet-level department, an independent agency, or a high-level division or unit within a department.

Agency-Level Data Collection

Welcome! This is the data collection survey for the following initiative: (activity_title).

This section contains information related to your agency and its administration of CCS activities.

If you are the agency point of contact, please fill out this section **before** forwarding on this link to the (activity_title) point of contact. If you do not have an agency point of contact, please fill this section out to the best of your knowledge.

Please note that once you are done with this section you will not be able to return to it. You will receive a warning when this section is coming to a close. Please ensure your responses reflect what you would intend to submit before moving on to the next section.

Primary Point of Contact for (activity_title) within your agency(response required).

○ First name _____

○ Last name _____

○ Email address _____

○ Phone number _____

Please select the status of (activity_title) during FY21 (select all that apply) (response required).

☐ Launched

☐ Ongoing

☐ Completed

☐ No activity occurred in FY21

Please select the status of (activity_title) during FY22 (select all that apply) (response required).

☐ Launched

☐ Ongoing

☐ Completed

☐ No activity occurred in FY22

Please select the authority under which (activity_title) was conducted (select all that apply) (response required).

☐ Crowdsourcing and Citizen Science Act

☐ Unknown

☐ Other authority (please specify):
_____

Provide name of sponsoring agency and office (if your office or component is not listed please select "other") (response required).

Agency

Office or component

▼ Administrative Conference of the United States ... World War I Centennial Commission ~ Other

----

If you selected "other" as an office or component please enter the name here.

○ Office or component _____

To the best of your ability, please indicate which of the following practices your agency uses to support crowdsourcing and citizen science activities. These questions specifically address practices at the level of an agency supporting individual CCS activities. In this context, "agency" can refer to a cabinet-level department, an independent agency, or a high-level division or unit within a department (select all that apply).
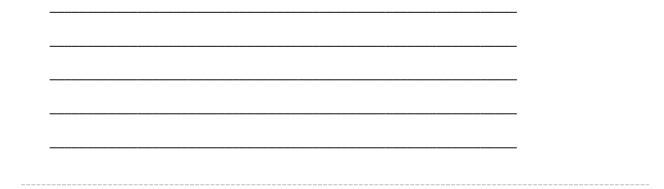
☐ Agency has issued agency-wide policy or guidance on the use of CCS

☐ CCS is included in agency-wide plans

☐ Agency has articulated connections of how the use of CCS activities support the agency's mission

☐ CCS is integrally or routinely used in agency science products

☐ Agency leverages existing platforms or tools to conduct CCS activities

☐ Agency uses internal communication tools to support CCS

☐ Agency carries out coordinated external communications or maintains a webpage for CCS

☐ Agency has a dedicated, full-time CCS coordinator

☐ Agency has identified a CCS point of contact (not dedicated full-time to CCS)

☐ Agency has a distributed network or community of project managers and/or resource people within the agency with expertise in CCS

☐ Agency provides centralized training and design support for staff conducting CCS activities

☐ Agency has developed or is in the process of developing a generic Information Collection Request (ICR) for CCS activities

☐ Agency offers grant funding to support implementation of CCS

☐ Not Applicable (N/A) or Unknown

✳

Please describe the specific ways in which the results of (activity_title) have been or will be used by the agency to advance its mission (approximately 150 words).

_____

_____

_____

_____

_____

Please indicate how the results of (activity_title) (e.g., data gathered, analyses produced, communities engaged) have been or will be used by Federal agencies or partners (select all that apply).

☐　Promote public science literacy

☐　Provide education or training to the public

☐　Produce novel data

☐　Augment existing data

☐　Advance ongoing scientific research

☐　Provide data or tools to the public

☐　Inform agency planning or decision-making

☐　Inform community planning or decision-making

☐　Support community efforts reliant on scientific understanding

☐　Produce publications or presentations

☐　Encourage community engagement on the activity topic

☐　Other (please specify) _____

End of Block: Agency Information 2

Start of Block: Agency Information 3

Does your office award grants or other forms of financial support to non-Federal entities (e.g., academic institutions, philanthropic organizations) to carry out crowdsourcing or citizen science activities?

○ Yes

○ No

○ Not Applicable (N/A) or Unknown

For these grant funded activities that are carried out by non-Federal entities, please provide the following information: 1) Name of the activity; 2) primary sponsor of the activity (e.g., awardee or institution); and 3) a short description of the activity (e.g., who was the audience? what activity was done? was the activity online or in-person? what was the outcome?) (max 75 words per activity).

_____

_____

_____

_____

_____

Page Break

This marks the end of the agency-level information. By clicking next you advance the survey onto activity-level information. No one from your agency will be able to go back to this section.

Activity-Level Data Collection

 Welcome! This is the data collection survey for the following initiative: (activity_title). As the activity/program point of contact, please fill out this section but **DO NOT PRESS SUBMIT** until you have cleared your response through your agency's clearance process, if applicable.

 If you have an agency point of contact, make sure to let them know when you have finished inputting your program information so they may review your responses and submit the form.

 Your progress will be auto-saved and you will be able to access your submission as long as you are on the same browser. You will receive a warning when this section is coming to a close.

✳

Please provide a summary of (activity_title) suitable for broad, public dissemination. This summary may be included in the formal report to Congress as, for example, a case study (max 300 words) (response required).

_____

_____

_____

_____

_____

Please specify when the activity was opened to the public for participation (e.g., data collection, submission); If activity's start date precedes FY21, please state when it originally started.

_____

Please provide link to the webpage for (activity_title). You may enter more than one, if appropriate. If there is no on-line link, please answer "N/A."

_____

_____

_____

_____

_____

*

If available, please submit any additional media links, blog posts, videos, etc., and/or relevant public quotes from agency personnel, partners, or participants (approximately 100 words).

_____

_____

_____

_____

_____

Please indicate if you would like for (activity_title) to be included in the catalog on Citizenscience.gov. If you answer "yes," you will be contacted by a member of the Citizenscience.gov team to assist with content implementation.

○ Yes, I would like to include this activity in the catalog on Citizenscience.gov.

○ No, I would not like to include this activity in the catalog on Citizenscience.gov.

○ The activity is already included in the catalog on Citizenscience.gov.

End of Block: Activity Information 1

Start of Block: Activity Information 2

Please indicate whether (activity_title) was designed and implemented to address a national health crisis or emergency (e.g. COVID-19)

○ Yes

○ No

Please indicate whether this activity was implemented as part of a larger, coordinated response to said national health crisis or emergency.

○ Yes

○ No

✳

Please describe briefly how this activity supported the larger, coordinated effort (max 200 words).

_____

_____

_____

_____

_____

Your agency point of contact indicated that (activity_title) is ongoing, please provide the anticipated end date in mm/dd/yyyy format. If there is no anticipated end date, please put "N/A."

_____

Your agency point of contact indicated that (activity_title) has ended, please provide the date when participation ceased in mm/dd/yyyy format.

_____

Please indicate whether (activity_title) occurred as discrete events on specific dates.

○ Yes, the CCS activity occurred as discrete events on specific dates.

○ No, the CCS activity did not occur as discrete events on specific dates.

You indicated that (activity_title) occurred within the FY21-22 reporting period as a discrete event(s) on specific dates. Please provide the specific dates (in mm/dd/yyyy format) during which the activity(ies) took place.

_____

_____

_____

_____

_____

Please indicate whether (activity_title) took place in a physical location(s) (e.g., town, city, county, region, territory) or if it was a virtual activity. (response required)

○ Physical location(s)

○ Virtual activity

○ Combination of both

Please indicate the physical location (e.g., town, city, county, region, territory) where (activity_title) took place. List multiple locations, if appropriate.

_____

_____

_____

_____

_____

If the virtual activity focused on a particular location, region, or territory, please indicate the physical location (town, city, county, region, territory etc.) where (activity_title) focused. List multiple locations, if appropriate.

_____

_____

_____

_____

Please indicate whether the CCS participants provided consent to take part in (activity_title).

    ◯ Yes, participants were asked to provide formal consent to participate in the CCS activity

    ◯ No, participants were NOT asked to provide formal consent to participate in the CCS activity

End of Block: Activity Information 4

Start of Block: Activity Information 5

If during the course of (activity_title) there was a specific effort to engage any of the below groups, please select which group(s) or identities these effort(s) were designed to reach: (response required)

- ⊗ No specific intended group
- ☐ Ethnic group
- ☐ Racial group
- ☐ Language group
- ☐ Sexual orientation
- ☐ Gender identity
- ☐ Socioeconomic status
- ☐ Veteran status
- ☐ Disability status
- ☐ Educational level
- ☐ Age
- ☐ Geographic Area (e.g. Urban or Rural)
- ☐ Other (please specify): _____

You indicated that you made a specific effort to engage certain group(s). Please describe the effort(s) you made to engage these group(s).

_____

_____

_____

_____

_____

Did (activity_title) specifically engage underrepresented populations in Science, Technology, Engineering, and Mathematics (STEM)? (response required)

○ Yes

○ No

⤬

Please select which underrepresented populations were specifically engaged by (activity_title) (select all that apply).

☐ Black/African-American populations

☐ Hispanic or Latino populations

☐ Indigenous populations

☐ Women, girls, and/or non-gender conforming people

☐ Persons with disabilities

☐ Other (please specify) _____

Please provide an estimate of the total number of unique individuals who participated in (activity_title) for each fiscal year. If it is not possible to estimate, please enter "N/A."

   ○ Estimated number of participants for FY21

_____

   ○ Estimated number of participants for FY22

_____

End of Block: Activity Information 5

Start of Block: Activity Information 6

Please indicate any objectives of the CCS Act that were addressed by the participants (select all that apply).

☐   Enable the formulation of research questions

☐   Create and refine project design

☐   Conduct scientific experiments

☐   Collect and analyze data

☐   Interpret the results of data

☐   Develop technologies and applications

☐   Make discoveries

☐   Solve problems

☐   ⊗No CCS Act objectives were addressed

Please indicate the intended goals of (activity_title) (select all that apply).

☐   Education

☐   Digitization of agency-owned materials

☐   Collection of data or observations

☐   Analyzing existing agency data

☐   Public outreach or engagement

☐   Creating or engaging a specific community

☐   Other (please specify): _____

✳

Please explain why CCS was chosen to achieve the intended goals (approximately 150 words).

_____

_____

_____

_____

_____

⤬

If applicable, please indicate the broad nature of the contributions or tangible deliverables **provided by** the participants (select all that apply).

☐   Participants submitted data or observations they collected

☐   Participants processed data or other materials provided by the agency

☐   Submissions or materials included images

☐   Submissions included information on location or geospatial coordinates

☐   ⊗ Not applicable

☐   Other (please specify): _____

Please indicate whether data or results generated from (activity_title) have been or will be made publicly available.

○ Yes, data and/or results have been or will be made publicly accessible

○ No, data and/or results have not been made publicly accessible

○ N/A: no data or results were collected as part of this project

Please indicate where and how the data can be accessed (e.g., web link; approximately 50 words).

○ Where data can be accessed _____

○ How data can be accessed _____

Please indicate the nature of the available product.

☐   Data visualization or map

☐   Interactive digital resources

☐   Educational materials

☐   Online presentation(s), publication(s), or report(s)

☐   Peer-reviewed scientific publication(s)

☐   Transcriptions

☐   Museum exhibits

☐   Programming script (e.g., R, Python, Java)

☐   Open-access repository (e.g., GitHub, Gitlab)

☐   Tools or guidance

☐   Publicly available data (please specify format)
_____

☐   Other (please specify) _____

✱

Please indicate why the data have not been made publicly available (approximately 100 words).

_____

_____

_____

_____

_____

Provide a best estimate of the dollar amount the agency used in support of (activity_title) (note: partner contributions will be asked in a separate question).

○ FY21 _____

○ FY22 _____

Please describe how (activity_title) is funded and/or supported. Include information about the sources of funding (private, public and/or in-kind).

_____

_____

_____

_____

_____

Please indicate how agency funds were used to support (activity_title) (select all that apply).

☐ Purchase of consumable materials

☐ Purchase or rental of equipment

☐ Transportation of participants

☐ Publicity, advertising, outreach, or/and communications

☐ Web portal or application development and support

☐ Database development

☐ Software development

☐ Data entry or/and analysis

☐ Contracted services

☐ Federal employee travel

☐ Training

☐ ⊗ N/A: no agency funds or other non-employee resources were used

☐ Other (please specify): _____

Please provide the number of Federal personnel who contributed to (activity_title).

○ FY21 _____

○ FY22 _____

Please indicate the extent of the contributions of these personnel (select all that apply).

☐   Federal personnel contribute to (activity_title) part-time, in addition to primary responsibilities

☐   The design and implementation of (activity_title) is a primary responsibility of Federal personnel

☐   Federal personnel contribute to (activity_title) full-time

Please indicate the total number of active partnering agencies or organizations involved with (activity_title). (response required)

○ 0 partners

○ 1 partner

○ 2 partners

○ 3 partners

○ 4 partners

○ 5 partners

○ >5 partners (please specify how many)

_____

Please provide the name of the active partnering agency/organization. (response required)

- ○ Partner 1 _____
- ○ Partner 2 _____
- ○ Partner 3 _____
- ○ Partner 4 _____
- ○ Partner 5 _____

X→

Please provide the type of partnering agency/organization.

	Federal Agency or Office	State or Local Government	Academic Institution	Nonprofit Organization (excluding Academic Institutions)	Private Industry	Other
Partner 1	○	○	○	○	○	○
Partner 2	○	○	○	○	○	○
Partner 3	○	○	○	○	○	○
Partner 4	○	○	○	○	○	○
Partner 5	○	○	○	○	○	○

X→

Please indicate the type(s) of contribution provided by the partner(s) (select all that apply).

	Funding	Personnel	Space	Consumable resources	Online support	Other
Partner 1	☐	☐	☐	☐	☐	☐
Partner 2	☐	☐	☐	☐	☐	☐
Partner 3	☐	☐	☐	☐	☐	☐
Partner 4	☐	☐	☐	☐	☐	☐
Partner 5	☐	☐	☐	☐	☐	☐

X→

You indicated that the following partner(s) provided other contributions. Please specify the contribution(s) provided here:

○ Partner 1 _____

○ Partner 2 _____

○ Partner 3 _____

○ Partner 4 _____

○ Partner 5 _____

X→

Please list the activities or contributions made by the personnel.

    ◯ Partner 1 _____

    ◯ Partner 2 _____

    ◯ Partner 3 _____

    ◯ Partner 4 _____

    ◯ Partner 5 _____

X→

Please indicate which fiscal years the following partner(s) provided contributions.

	FY21	FY22
Partner 1	☐	☐
Partner 2	☐	☐
Partner 3	☐	☐
Partner 4	☐	☐
Partner 5	☐	☐

X→

Please indicate the approximate monetary value of the contribution(s) provided by the following partner(s) by fiscal year.

	FY21	FY22
Partner 1		
Partner 2		
Partner 3		
Partner 4		
Partner 5		

Page Break

Please indicate if (activity_title) has been evaluated in terms of its impact, stated goals, or participant engagement. (response required)

○ Yes, (activity_title) has been evaluated

○ No, (activity_title) has not been evaluated

✳

You indicated that you evaluated (activity_title). Please describe how you evaluated (activity_title) (max 250 words).

_____

_____

_____

_____

_____

✳

Please describe the results of this evaluation (max 250 words).

_____

_____

_____

_____

_____

✳

If a report on the evaluation of (activity_title) is publicly available, please post the URL in the field below.

_____

This is the end of the survey. By clicking the "next page" button below you will have an opportunity to review your responses and print or save/export a PDF of the survey questions and your responses for any approval process you may need to execute at your agency prior to final submission to STPI. We strongly recommend that you save/export your results at this stage.

DO NOT PRESS SUBMIT UNLESS YOU ARE AN AGENCY POINT OF CONTACT OR YOUR SUBMISSION HAS BEEN REVIEWED AND APPROVED BY THE APPROPRIATE AGENCY CHANNELS.