

**(b) Data management plans****(1) In general**

The Director shall require that every proposal for funding for research include a machine-readable data management plan that includes a description of how the awardee will archive and preserve public access to data, software, and code developed as part of the proposed project.

**(2) Requirements**

In carrying out the requirement in paragraph (1), the Director shall—

(A) provide necessary resources, including trainings and workshops, to educate researchers and students on how to develop and review high quality data management plans;

(B) ensure program officers and merit review panels are equipped with the resources and training necessary to review the quality of data management plans; and

(C) ensure program officers and merit review panels treat data management plans as essential elements of award proposals, where appropriate.

**(c) Open repositories**

The Director shall—

(1) consult with the heads of other Federal research agencies, as appropriate, and solicit input from the scientific community, to develop and widely disseminate a set of criteria for trusted open repositories to be used by Foundation-funded researchers, accounting for discipline-specific needs and necessary protections for sensitive information;

(2) work with stakeholders to identify significant gaps in available repositories meeting the criteria developed under paragraph (1) and options for supporting the development of additional or enhanced repositories;

(3) make awards on a competitive basis to institutions of higher education or non-profit organizations (or consortia of such institutions or organizations) for the development, upgrades, and maintenance of open data repositories that meet the criteria developed under paragraph (1);

(4) work with stakeholders and build on existing models, where appropriate, to establish a single, public, web-based point of access to help users locate repositories storing data, software, and code resulting from or used in Foundation-supported projects;

(5) work with stakeholders to establish the necessary policies and procedures and allocate the necessary resources to ensure, as practicable, data underlying published findings resulting from Foundation-supported projects are deposited in repositories meeting the criteria developed under paragraph (1) at the time of publication;

(6) incentivize the deposition of data, software, and code into repositories that meet the criteria developed under paragraph (1); and

(7) coordinate with the scientific publishing community and the heads of other relevant Federal departments and agencies to support the development of voluntary consensus standards around data archiving and sharing.

**(d) Research, development, and education**

The Director shall make awards, on a competitive basis to institutions of higher education or non-profit organizations (or consortia of such institutions or organizations) to—

(1) support research and development of open source, sustainable, usable tools and infrastructure that support reproducibility for a broad range of studies across different disciplines;

(2) support research on computational reproducibility, including the limits of reproducibility and the consistency of computational results in the development of new computational hardware, tools, and methods; and

(3) support the education and training of students, faculty, and researchers on computational methods, tools, and techniques to improve the quality and sharing of data, code, and supporting metadata to produce reproducible research.

(Pub. L. 117-167, div. B, title III, §10344, Aug. 9, 2022, 136 Stat. 1558.)

**§ 19054. Climate change research**

The Director shall make awards, on a competitive basis, to institutions of higher education or non-profit organizations (or consortia of such institutions or organizations) to support research to improve our understanding of the climate system and related human and environmental systems.

(Pub. L. 117-167, div. B, title III, §10345, Aug. 9, 2022, 136 Stat. 1560.)

**§ 19055. Social, behavioral, and economic sciences**

The Director shall—

(1) actively communicate opportunities and solicit proposals for social, behavioral, and economic science researchers to participate in cross-cutting and interdisciplinary programs, including the Convergence Accelerator and agency priority activities, and the Mid-Scale Research Infrastructure program; and

(2) ensure social, behavioral, and economic science researchers are represented on relevant merit review panels for such activities.

(Pub. L. 117-167, div. B, title III, §10346, Aug. 9, 2022, 136 Stat. 1560.)

**§ 19056. Measuring impacts of Federally funded research and development**

The Director shall make awards on a competitive, merit-reviewed basis to institutions of higher education or non-profit organizations (or consortia of such institutions or organizations) to support research and development of data, models, indicators, and associated analytical tools to improve our understanding of the impacts of Federally funded research on society, the economy, and the workforce, including domestic job creation.

(Pub. L. 117-167, div. B, title III, §10347, Aug. 9, 2022, 136 Stat. 1560.)

**§ 19057. Food-energy-water research**

The Director shall make awards on a competitive basis to institutions of higher education or

non-profit organizations (or consortia of such institutions or organizations) to—

- (1) support research to significantly advance our understanding of the food-energy-water system through quantitative and computational modeling, including support for relevant cyberinfrastructure;
- (2) develop real-time, cyber-enabled interfaces that improve understanding of the behavior of food-energy-water systems and increase decision support capability;
- (3) support research that will lead to innovative solutions to critical food-energy-water system problems; and
- (4) grow the scientific workforce capable of studying and managing the food-energy-water system, through education and other professional development.

(Pub. L. 117–167, div. B, title III, §10348, Aug. 9, 2022, 136 Stat. 1560.)

#### **§ 19058. Biological field stations and marine laboratories**

The Director shall continue to support enhancing, repairing and maintaining research instrumentation, laboratories, telecommunications and housing at biological field stations and marine laboratories.

(Pub. L. 117–167, div. B, title III, §10349, Aug. 9, 2022, 136 Stat. 1560.)

#### **§ 19059. Sustainable chemistry research and education**

In accordance with section 9303 of title 15, the Director shall carry out activities in support of sustainable chemistry, including—

- (1) establishing a program to make awards, on a competitive basis, to institutions of higher education or non-profit organizations (or consortia of such institutions or organizations) to support—
  - (A) individual investigators and teams of investigators, including to the extent practicable, early career investigators for research and development;
  - (B) collaborative research and development partnerships among universities, industry, and non-profit organizations;
  - (C) integrating sustainable chemistry principles into elementary, secondary, undergraduate, and graduate chemistry and chemical engineering curriculum and research training, as appropriate to that level of education and training; and
- (2) incorporating sustainable chemistry into existing Foundation research and development programs.

(Pub. L. 117–167, div. B, title III, §10350, Aug. 9, 2022, 136 Stat. 1560.)

#### **§ 19060. Risk and resilience research**

The Director shall make awards on a competitive basis to institutions of higher education or non-profit organizations (or consortia of such institutions or organizations) to advance knowledge of risk assessment and predictability and to support the creation of tools and technologies, including advancing data analytics and

utilization of artificial intelligence, for increased resilience through—

- (1) improvements in our ability to understand, model, and predict extreme events and natural hazards;
- (2) the creation of novel engineered systems solutions for resilient complex infrastructures, particularly those that address critical interdependence among infrastructures and leverage the growing infusion of cyber-physical-social components into the infrastructures;
- (3) development of equipment and instrumentation for innovation in resilient engineered infrastructures;
- (4) multidisciplinary research on the behaviors individuals and communities engage in to detect, perceive, understand, predict, assess, mitigate, and prevent risks and to improve and increase resilience; and
- (5) advancements in multidisciplinary wildfire science, including those related to air quality impacts, human behavior, and early detection and warning.

(Pub. L. 117–167, div. B, title III, §10351, Aug. 9, 2022, 136 Stat. 1561.)

#### **§ 19061. Unmanned aircraft systems technologies**

In coordination with the Administrator of the Federal Aviation Administration and the Administrator of the National Aeronautics and Space Administration, the Director shall carry out a program of research and related activities related to unmanned aircraft system technologies, which may include a prize competition pursuant to section 3719 of title 15 and support for undergraduate and graduate curriculum development.

(Pub. L. 117–167, div. B, title III, §10352, Aug. 9, 2022, 136 Stat. 1561.)

#### **§ 19062. Accelerating unmanned maritime systems technologies**

##### **(a) In general**

In order to support advances in marine science, maritime domain awareness, and national security the Director, in consultation with the Under Secretary of Commerce for Oceans and Atmosphere and the Commandant of the Coast Guard, shall issue awards, on a competitive basis, to institutions of higher education or nonprofit organizations (or consortia of such institutions or organizations) to support research that will accelerate innovation to advance unmanned maritime systems for the purpose of providing greater maritime domain awareness to the Nation.

##### **(b) Coordination**

In implementing this section, the Director shall coordinate with the Coast Guard, the Department of Defense, the National Oceanic and Atmospheric Administration, and other Federal agencies, including those established under the Commercial Engagement Through Ocean Technology Act of 2018 (Public Law 115–394) [33 U.S.C. 4101 et seq.].

(Pub. L. 117–167, div. B, title III, §10353, Aug. 9, 2022, 136 Stat. 1561.)