

SCIENCE MISSION DIRECTORATE POLICY
Scientific Information Policy for the Science Mission Directorate

SMD Policy Document SPD-41a

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Responsible SMD Official: Chief Science Data Officer

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Approved by:

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Date

I. Background

The scientific knowledge produced as part of NASA’s scientific activities represents a significant public investment. NASA holds this scientific information, defined as scientific knowledge produced as part of a research activity, as a public trust to increase understanding and serve the public good. This scientific information includes, but is not limited to, publications, data, and software created in the pursuit of scientific knowledge. Results of federally funded research and development should be shared openly, in accordance with existing NASA policies and programmatic goals to maximize the benefit and reach of the scientific information. Data should not only be archived but also be curated – that is, the data are assured to have continued accessibility and usability for multiple decades. The free and open availability of software enhances the discoverability, accessibility, sustainability, and reproducibility of NASA science while maximizing the benefit of NASA to society.

It is Science Mission Directorate (SMD) policy, consistent with Federal policy^{1,2} and the [NASA Plan for Increasing Access to the Results of Scientific Research](#), that scientific information produced from SMD-funded scientific activities be made publicly available to the extent legally permitted³.

The policy describes how scientific information produced from SMD funding can be shared. Scientific information includes publications, data, and software produced as part of scientific activities. Publications include scientific or technical documents released through print, electronic, or alternative media. Data include any scientifically or technically relevant, electronically stored information. Software includes scientifically or technically relevant computer programs in both source and object code that provide users some degree of utility or produce a result or service.

The policy was created based on recommendations from [SMD's Strategy for Data Management and Computing for Groundbreaking Science 2019-2024](#) and is based on existing Government directives, NASA policy, community best practices, studies by the National Academies, and community-led best practices (see references listed in Appendix A). The policy provides a summation of requirements and guidelines for sharing of SMD scientific information. Further details are provided in division policy documents, solicitations or announcements of opportunities, or the governing documents as provided in the footnotes or Appendix A. Definitions of the terms used throughout this document are provided in Appendix B. A list of acronyms used in this document is provided in Appendix C. The process for variances to the policy is described in Section IX. Submit any questions about the policy to HQ-SMD-SPD41@list.nasa.gov.

II. Applicability

- A. This policy applies to all SMD-funded scientific activities to the extent possible, regardless of the funding vehicle. This shall include, at a minimum:

¹ [Increasing Access to the Results of Federally Funded Research](#)

² [Ensuring Free, Immediate, and Equitable Access to Federally Funded Research](#)

³ Seek specific advice from the Chief Science Data Office, Office of General Counsel or Center Counsel, your Intellectual Property counsel, or cognizant authority, as appropriate

- i. Mission scientific information produced by SMD-funded flight missions. Missions include strategic or flagship missions and flight investigations selected under Announcements of Opportunity (AO). This can include investigations executed using a Principal Investigator-managed mission, a mission directed to a NASA implementing institution, or a mission implemented by a NASA partner. This class of information will be referred to as ‘Mission’ information in this document.
 - ii. Research scientific information produced by a science investigation funded via research award(s). This includes, but is not limited to, investigations selected under a Notice of Funding Opportunity (NOFO) as set forth in the Code of Federal Regulations, Title 2 Grants and Agreements; NASA Research Announcements (NRAs), including Research Opportunities in Space and Earth Science (ROSES) NRAs; and other types of Broad Agency Announcements (BAAs), including Cooperative Agreement Notices (CANs). This also includes research awards for scientific investigations that are Mission-funded via an Agency contract (e.g., Hubble Space Telescope observing awards). This class will be referred to as ‘Research’ information in this document.
 - a) Research awards can include grants, cooperative agreements, contracts, task orders, interagency transfers, direct internal NASA funding, and other applicable funding vehicles.
 - iii. Scientific information produced by all other SMD-funded scientific activities, such as, but not limited to, experiments, investigations using sub-orbital platforms, airplanes, field campaigns, or citizen science projects. Unless stated otherwise, the scientific information produced by these activities will follow the same policies as those for Research scientific information.
- B. This policy applies to scientific information produced by SMD-funded scientific activities to the extent legally practicable and in accordance with other established NASA policies (see Appendix A). This includes:
- i. Publications: Scientific and technical documents released through print, electronic, or alternative media.
 - a) This includes peer reviewed manuscripts, technical reports, conference materials, and books.
 - b) This does not include internal reports, laboratory notebooks, preliminary analyses, drafts of scientific papers or preprints, plans for future research, peer review reports, proposals, or communications with colleagues.
 - ii. Data: Scientific or technically relevant information that can be stored digitally and accessed electronically.
 - a) Information produced by missions includes observations, calibrations, coefficients, documentation, algorithms, and any ancillary information. Further definitions of mission data and examples are provided in Appendix E.
 - b) Information needed to validate the scientific conclusions of peer-reviewed publications. This includes the data required to derive the findings communicated in figures, maps, and tables.
 - c) This does not include laboratory notebooks, preliminary analyses, intermediate data products, drafts of scientific papers, plans for future research, peer review reports, communications with colleagues, or physical objects, such as laboratory specimens.

- iii. Software: Computer programs, including source and object code, that provide users some degree of utility or service. Further definitions and examples of software are provided in Appendix F.
 - a) Scientific software is software that provides users some degree of scientific utility or produces a scientific result or service.
 - b) This does not include software developed only for preliminary analysis, plans for future research, or communication with colleagues.
- C. Information subject to specific laws, regulations, or policies that would prevent the release of this information are exempt from this policy. The relevant laws, regulations, and policies that generate exceptions include but are not limited to:
 - i. patent or intellectual property laws including the Bayh-Dole Act,
 - ii. the Export Administration Regulations (EAR),
 - iii. the Health Insurance Portability and Accountability Act (HIPAA),
 - iv. the International Traffic in Arms Regulations (ITAR),
 - v. the Freedom of Information Act (FOIA),
 - vi. NASA STD 1006.1 Space System Protection Standard,
 - vii. NASA NPR 2810.7 Controlled Unclassified Information, and
 - viii. the Federal laws and regulations governing classified information or security requirements.
- D. This policy does not take precedence over requirements of the FAR and NASA FAR Supplement or requirements in NASA policy. The most relevant NASA policies are listed in Appendix A.
- E. New missions and investigations shall follow all parts of this policy. Existing missions and investigations should adopt parts of this policy consistent with available resources.
 - i. Any SMD-led missions that have not yet reached the Key Decision Point-B milestone as of three months from the date of adoption of this policy shall follow all parts of this policy. This includes missions that are selected under solicitations that are open or under consideration at the time of adoption of this policy. Missions beyond this point should adopt all parts of this policy consistent with available resources.
 - ii. This policy remains subject to all existing requirements, contractual and agreement obligations, applicable laws, and other Agency-wide policies and mandates. Requirements or contracts may be updated to include this policy.
 - iii. This policy is applicable to all components of an SMD-led mission, including partner-contributed instruments. This policy does not take precedence over existing requirements, contractual and agreement obligations, applicable laws, and other Agency-wide policies and mandates for partner-contributed instruments.
- F. There are no requirements in this policy on information produced from activities that are not funded by SMD.
- G. This policy does not apply to pre-decision information collected or produced as part of a proposal or award review.
- H. In this policy, all mandatory actions (i.e., requirements) are denoted by statements containing the term “shall.” The terms “may” or “can” denote discretionary privilege or permission; “should” denotes a good practice that is recommended, but not required; “will” denotes an expected outcome; and “are/is” denotes descriptive material.

III. General Policies

To further NASA's goal of enabling widespread access to the results of NASA SMD-funded research, the following policies apply to all SMD-funded scientific activities:

- A. All SMD-funded publications (i.e., publications resulting from research funded by SMD) shall be made publicly accessible to the extent allowed by applicable law and existing NASA policies.
 - i. As-accepted, peer reviewed manuscripts shall be deposited in NASA's as-accepted manuscript repository and shall be made freely available by default, without any embargo or delay after the publication date.⁴
- B. Scientific data underlying peer reviewed manuscripts resulting from SMD-funded scientific activities shall become publicly available, to the extent allowed by applicable law and existing NASA policies, no later than the publication of the peer-reviewed article that describes it.⁵
 - i. This includes any information needed to validate the scientific conclusions of peer-reviewed publications that result from an award. This includes data required to derive the findings communicated in figures, maps, and tables.
 - ii. This does not include laboratory notebooks, preliminary analyses, drafts of scientific papers, plans for future research, peer review reports, communications with colleagues, or physical objects, such as laboratory specimens.
- C. The following policies are applicable to data that have been produced by SMD-funding upon these data being made publicly available:
 - i. SMD-funded data should follow the [FAIR Guiding Principles for scientific data management and stewardship](#). This means data should be findable, accessible, interoperable, and reusable (FAIR).
 - ii. Publicly available, SMD-funded data shall be made available without fee or restriction of use.⁶
 - a) In rare circumstances where a variance (see Section IX) has been granted to the free distribution of data, SMD will charge no more than the cost of dissemination for the distribution of data.⁷
 - iii. Data formats for SMD-funded data shall be machine-readable (i.e., data shall be reasonably structured to allow automated processing).⁸
 - iv. SMD-funded data shall be made available in non-proprietary, modifiable, and open formats.⁹
 - v. SMD-funded data shall be findable, such that the data can be retrieved, downloaded, indexed, and searched.
 - vi. SMD-funded data shall include robust, standards-compliant metadata that clearly and explicitly describe the data.
 - vii. Publicly available SMD-funded data shall be reusable with a clear, open, and accessible data license.¹⁰
 - a) If there are no other restrictions, SMD scientific data should be released with a Creative Commons Zero license. Legal limitations on data may

⁴ Ensuring Free, Immediate, and Equitable Access to Federally Funded Research

⁵ NASA Plan for Increasing Access to the Results of Scientific Research

⁶ OPEN Government Data Act

⁷ OMB A-130

⁸ OPEN Government Data Act

⁹ OPEN Government Data Act

¹⁰ OPEN Government Data Act

include, but are not limited to, limited rights data, data governed by incompatible licenses, or data containing restricted information. Seek specific advice from the Chief Science Data Office or Intellectual Property Counsel, as needed.

- viii. Publicly available SMD-funded data collections shall be citable using a persistent identifier.
 - a) SMD should encourage users to cite the sources of the data used to conduct peer-reviewed, published research.
 - ix. SMD-funded data collections shall be indexed as part of the NASA catalog of data.¹¹
- D. The following policies are applicable to software that has been developed using SMD-funding upon its being made publicly available:
- i. Restricted software, as defined in Appendix B, shall not be made publicly available without approval through the cognizant authority. As such, Section III.D does not apply to restricted software.
 - ii. When released, SMD-funded software should follow best practices in the relevant open source and research communities.
 - iii. If there are no other restrictions, publicly available SMD-funded software should be released under a permissive license that has broad acceptance in the community.¹² Restrictions that may prevent release under a permissive license include, but are not limited by, software governed by incompatible licenses or inclusion of restricted computer software. Seek specific advice from the Chief Science Data Office or Intellectual Property Counsel, as needed.
 - a) For software developed at NASA Centers and released through the NPR 2210 process, Center Intellectual Property Counsel shall be consulted in the selection of the license to be used in the release of software, which may include Apache 2.0, BSD, or MIT.
 - iv. For publicly available software projects, SMD-funded software projects shall include a code of conduct and guidelines for how to make contributions.
 - v. When released as open source software, source code for SMD-funded software shall be made available in a publicly accessible repository that is widely recognized by the community.
 - vi. Publicly available SMD-funded software shall be reported by the developers of the software so it can be indexed as part of the NASA catalog of software.¹³
 - a) Single use software and commercial software do not need to be reported for indexing as part of the NASA catalog of software.
 - vii. Publicly available SMD-funded software shall be citable using a persistent identifier.
 - a) SMD should encourage users to cite all software used to conduct peer-reviewed, published research.¹⁴
- E. New technologies, including software, developed under SMD funding shall be reported to NASA at invention.nasa.gov.^{15,16}

¹¹ NPD 2200.1

¹² Open Source software policy options for Earth and Space Science

¹³ NPR 2210.1C

¹⁴ Open Source Software Policy Options for NASA Earth and Space Sciences

¹⁵ NPD 2091.1

¹⁶ NASA FAR Supplement 1852.227-70 and FAR 52.227-11

- F. All SMD-funded scientific activities shall include data management plans describing the management, preservation, and release of data to facilitate implementation of this policy.¹⁷
 - i. For some activities, such as those focused on education, a data management plan may not be required. However, the policy is still applicable to any scientific information produced during those activities.
- G. All SMD-funded scientific activities shall include a software management plan describing the management, preservation, and release of software to facilitate implementation of this policy.
 - i. For some activities, such as those focused on education, a software management plan may not be required. However, the policy is still applicable to any relevant scientific software produced during those activities.
- H. SMD-funded investigators shall have a persistent identifier that meets the standards of a digital persistent identifier service defined in the [NSPM-33 Implementation Guidance](#).
- I. Publicly available SMD-funded scientific information shall be archived, to the extent practicable, in SMD designated repositories or made available as described in SMD requirements or contract terms.
- J. During SMD proposal reviews, peer reviewed data and software shall be recognized as having the commensurate value as peer reviewed manuscripts.¹⁸
- K. Where applicable and to the extent practicable, data collected as part of SMD-funded crowdsourcing projects or citizen science projects, shall be made public to the extent allowed under applicable law and existing NASA policies.¹⁹
- L. Unless otherwise stated, other SMD-funded scientific activities (as described in II.A.iii) shall follow the same policies as for ‘research’ (as described in II.A.ii) in terms of release of data, software, and publications.

IV. Policies and Principles Applicable to the Science Mission Directorate

In addition to the policies described in Section III, the following policies and principles shall apply to the Science Mission Directorate:

- A. SMD shall provide funding to comply with this policy that is consistent with the proposed work and resources available. SMD shall provide guidance for how best to meet these policies and shall provide additional tools to support meeting these policies.²⁰
- B. Each SMD division shall provide further guidance on these policies for their communities, including the types of information that provide scientific utility.
- C. SMD policies should remain consistent with best practices to maximize access to scientific information and to keep costs as low as possible.²¹
- D. SMD shall provide a persistent identifier for all funding mechanisms and missions.
- E. In external agreements, SMD should encourage the adoption of similar policies by its partners to ensure the usability of the scientific information to the scientific community.²²

¹⁷ NPD 2230.1

¹⁸ Open Source Software Policy Options for NASA Earth and Space Sciences

¹⁹ American Innovation and Competitiveness Act

²⁰ Strategy for Data Management and Computing for Ground-Breaking Science 2019-2024

²¹ OMB A-130

²² NASA Plan for Increasing Access to the Results of Scientific Research

- i. SMD should engage in ongoing partnerships with other Federal agencies to increase the effectiveness and reduce the cost of its science program. Interagency cooperation should include sharing of data from satellites and other sources, mutual validation and calibration data, and consolidation of duplicative capabilities and functions.
 - ii. SMD should require that all information for scientific research is accessible when negotiating agreements with an international partner, another agency, a private entity, a commercial interest, or industry.
 - a) SMD shall restrict access to information only to the extent required by the governing Memorandum of Understanding (MOU) or other governing agreement, as well as applicable law and existing NASA policies.
- F. SMD should only participate in new partner-led missions where the data are openly shared with no period of exclusive access to the data. A period after the data have been obtained may be allowed for activities such as calibration and validation of the data. This period should be as short as possible but no longer than six months.
 - i. This includes partnerships where SMD's contribution is contributing instruments or use of SMD facilities.
 - ii. This does not include (a) partner-led missions where SMD has an existing agreement that predates the effective date of this policy, (b) commercial platforms or commercial data providers, or (c) research awards as described in Section II.A.ii.
 - iii. This does not include partnerships where SMD's contribution is limited to the participation of individuals funded by SMD.
 - iv. It is SMD's intent to require openly shared data, with no period of exclusive access to the data, in a future version of this policy. A notice period of 12 months will be provided prior to making a change to the requirement on participation in partner-led missions.
- G. SMD should encourage the adoption of open software policies with external partners, contractors, and grantees to ensure the usability of software to the scientific community. SMD shall foster and encourage contributions and engagement with the open source community from all Federal employees, contractors, and grantees. This includes leveraging existing open source software and communities.²³
- H. SMD should foster and encourage contributions and engagement with communities and organizations setting standards and best practices.^{24,25}

V. Policies Applicable to Repositories of Scientific Information

The following policies shall apply to the repositories designated for archiving for SMD-funded scientific information:

- A. Repositories designated as appropriate for archiving of SMD-funded scientific information shall align, to the extent practicable, to the National Science and Technology

²³ OMB M-16-21

²⁴ Strategy for Data Management and Computing for Ground-Breaking Science 2019-2024

²⁵ OMB M-16-21

Council document entitled [Desirable Characteristics of Data Repositories for Federally Funded Research](#).

- B. SMD-funded repositories shall comply, as appropriate, with standards for accessibility for all electronic and information technology to people with disabilities.²⁶
- C. SMD-funded repositories shall comply, to the extent practicable, with a principle of non-discriminatory data access so that all users will be treated equally. Any variation in accessibility of SMD data will result solely from the capability, equipment, and connectivity of the user.²⁷
- D. SMD funded repositories should have an Authorization to Operate (ATO) from NASA. If a designated repository is externally managed and not part of NASA network boundary, then there should be a Memorandum of Understanding signed by NASA and the external party about how science information would be shared.²⁸

VI. Additional Policies for Mission Information

In addition to the policies in Section III, the following policies shall apply to all information produced from SMD missions:

- A. SMD-funded publications describing the Mission²⁹ shall be made publicly accessible via a NASA designated repository at the time of their publication. This includes technical reports, peer-reviewed publications, conference proceedings, dissertations, and books.
- B. To support reproducibility, SMD commits to the full and open sharing of information produced by NASA SMD Missions to the extent allowed by applicable law and existing NASA policies. This includes observations, calibrations, coefficients, documentation, algorithms, software, technical reports, and any ancillary information or work product related to the Mission.
- C. There shall be no period of exclusive access to Mission data. A period after the data have been obtained may be allowed for activities such as calibration and validation of the data. This period shall be as short as possible and shall not exceed six months.
- D. Mission software released by NASA shall be released through the NASA software release authority³⁰. If not released by NASA, Mission software shall be released as described in the mission requirements or contract terms.
- E. Mission software shall be developed openly in a publicly accessible, version-controlled platform that allows for contributions and engagement from the community.
 - i. This does not apply to restricted or commercial software. Restricted software includes, but is not limited to, software described as restricted in Mission requirements, systems as defined in NASA STD 1006.1 including those for command and control, ITAR or export-controlled software, or software with limited release due to security requirements. For Mission software, projects should engage with the cognizant authority to determine their status, as needed.

²⁶ Section 508 of the US Rehabilitation Act

²⁷ OMB A-130

²⁸ [NASA Cybersecurity and Privacy Handbooks](#)

²⁹ Mission data are released into the public domain and non-SMD-funded activities have no requirements with respect to the usage of that data

³⁰ NPR 2210.1C Release of NASA Software

- ii. Mission software includes all unrestricted software for a mission, including software developed for operations, planning, data acquisition, processing, and analysis.

VII. Additional Policies for Research Information

In addition to the policies in Section III, the following policies shall apply to all information produced from SMD-funded research:

- A. At the end of the period of performance of a research award, scientifically useful data associated with the award that has not already been made public shall be made publicly available to the extent allowed by applicable law and existing NASA policies.
- B. Scientifically useful data from models and simulations developed using SMD funding shall be made available at the time of publication of the peer reviewed manuscript that describes the scientific results. Each SMD division shall provide further guidance on the requirements for the sharing of outputs from models and simulations.
- C. To achieve reproducibility, scientific software developed using SMD funding and used in support of a scientific, peer-reviewed publication shall be released as open source software no later than the publication date.
 - i. This does not include restricted or commercial software. Restricted software should be identified in the software management plan for the scientific activity. This includes scientific software for which release is limited by patent rights, as described in the governing document of the funding mechanism, including “Patent Rights for Small Business Firms and NonProfit Organizations.”
 - ii. Scientific software developed as part of a previous work and not previously made openly available should be released as open source software if enhancements were made as part of the SMD-funded work and the software is used in support of a scientific, peer-reviewed publication. Enhancements include new functionality that adds scientific utility to the software, but it does not include bug fixes or optimization of the software.
 - iii. This does include software developed in a proprietary or commercial software language, if allowed by the license.
 - iv. This does not require the software to be maintained or supported.
- D. At the end of the period of performance of a research award, scientific software developed as part of the award, to extent practicable, shall be released as open source software if allowed under existing laws and regulation.
 - i. This does not include restricted or commercial software. Restricted software should be identified in the software management plan for the scientific activity. This includes scientific software for which release is limited by patent rights, as described in the governing document of the funding mechanism, including “Patent Rights for Small Business Firms and NonProfit Organizations.”
 - ii. This does include software developed in a proprietary or commercial software language if allowed by the license.
 - iii. This does not require the software to be maintained or supported.
- E. Variances to the requirements in Section VII may be requested from the program officer; the program officer has the authority to approve, modify, or decline the Section VII

requirements variance requested. Any variances for a period longer than one year require review by the Chief Science Data Officer.

VIII. Additional Policies for SMD-funded Science Events

The following policies shall apply to science events, including but not limited to conferences, workshops, and symposia:

- A. A public, science event for which SMD is the primary sponsor shall make the scientific publications produced for the science event publicly accessible.
 - i. This does not include restricted information. Restricted information shall not be shared publicly, and if any material with restricted information is shared openly, then the restricted information shall be redacted prior to publicly sharing the material.
 - ii. This includes publications, presentations, media, or other materials produced as part of the event. This material shall be deposited in the appropriate NASA designated repository.
 - iii. This does not include laboratory notebooks, preliminary analyses, drafts of scientific papers or preprints, plans for future research, peer review reports, or communications with colleagues.
- B. Participants sponsored with SMD funding to attend conferences, workshops, or symposia shall deposit their public scientific publications produced for the event in an appropriate NASA designated repository.
- C. SMD-supported science events for which SMD is not the primary sponsor should be encouraged to make the publications produced as part of the event publicly accessible.
- D. Private SMD-funded science events, including but not limited to team meetings or mission reviews, should consider what scientific information produced as part of the event should be made publicly available.

IX. Variances

- A. The SMD Associate Administrator (AA) is the final authority on this policy and shall determine the reasonableness of any variances to it.
 - i. The SMD Chief Science Data Officer shall have authority to grant any variances to this policy consistent with existing NASA policies.
 - ii. Requests for variances to the policy may be submitted by the program or project manager or by the SMD program scientist or program officer, shall receive concurrence from the appropriate SMD Division Director, and approval from the SMD Chief Science Data Officer.
 - iii. Appeals to the SMD Chief Science Data Officer's decision may be submitted to the SMD AA, who has final approval authority for variances or deviations with dissent.
 - iv. Any of these named individuals (program or project manager, SMD program scientist or program officer, SMD Division Director, SMD Chief Science Data Officer, SMD AA) may delegate their responsibility, as needed.
 - v. Variances may be requested for an entire program or for an individual project.

- B. If available, the recommendations of any peer review panels will be considered as part of assessing the reasonableness of a variance.
- C. The individual SMD science divisions or offices may implement additional policies that build upon this policy to make information more accessible. This may extend this policy in a variety of ways, including but not limited to, adding characteristics to the definition of an acceptable data repository, specifying specific repositories that meet the requirements, or specifying a particular data format or file type.

X. Measurement and Verification

- A. SMD will collect a variety of metrics intended to measure or assess the efficacy of its data systems and services to determine user satisfaction. Consistent with applicable laws, SMD will make those metrics available for review and will conduct independent reviews on SMD compliance with this policy at least once every five years.
- B. This policy will be reviewed at least once every five years.

XI. Appendices

Appendix A. References

- NASA Policies
 - NPD 20911.C [Inventions Made by Government Employees](#)
 - NPD 2190.1C [NASA Export Control Program](#)
 - NPD 2200.1D [Management of NASA Scientific and Technical Information](#)
 - NPR 2200.2E [Requirements for Documentation, Approval and Dissemination of Scientific and Technical Information](#)
 - NPR 2210.1C [Release of NASA Software](#)
 - NPD 2230.1 [Research Data and Publication Access](#)
 - NPR 2810.7 [Controlled Unclassified Information](#)
 - NPD 7100.1 [Curation of Institutional Scientific Collections](#)
 - NPR 7150.2D [NASA Software Engineering Requirements](#)
 - NASA STD 1006.1 [Space System Protection Standard](#)
 - NASA [FAR Supplement 1852.227](#)
 - [NASA Plan for Increasing Access to the Results of Scientific Research](#)
 - [NASA Software Engineering Handbook](#)
 - [NASA Cybersecurity and Privacy Handbooks](#)
 - [NASA Regulations and Guidance](#)
 - NASA Grants and Cooperative Agreements Manual
 - NASA Guidebook for Proposers
- Acts
 - OPEN Government Data Act, as part of the [Foundations for Evidence Based Policymaking Act](#)
 - [American Innovation and Competitiveness Act](#)
 - [Bayh-Dole Act, Patent Rights in Inventions Made With Federal Assistance, 35 USC 200](#)

- [Geospatial Data Act of 2018](#)
- Memorandum and Government Directives
 - M-13-13: [Open Data Policy-Managing Information as an Asset](#)
 - OSTP [Increasing Access to the Results of Federally Funded Research](#)
 - Executive Order 13642: [Making Open and Machine Readable the New Default for Government Information](#)
 - OMB M-16-21: [Federal Source Code Policy: Achieving Efficiency, Transparency, and Innovation through Reusable and Open Source Software](#)
 - OMB A-130: [Managing Information as a Strategic Resource](#)
 - Section 508 [IT Accessibility](#)
 - Resources for open data: <https://resources.data.gov>
 - Nation Security Presidential Memorandum 33: [Supported Research and Development National Security Policy](#)
 - NSTC [NSPM-33 Implementation Guidance](#)
 - OMB A-119: [Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities](#)
 - OSTP [Desirable Characteristics of Data Repositories for Federally Funded Research](#)
 - [Controlled Unclassified Information](#)
 - [OSTP Ensuring Free, Immediate, and Equitable Access to Federally Funded Research](#)
- Reports
 - [SMD's Strategy for Data Management and Computing for Groundbreaking Science 2019-2024](#)
 - [NASA SMD Archives Processing and Data Exploitation Summary Report](#)
 - [NASA SMD Maximizing the Scientific Return of NASA Data Workshop Report](#)
 - [Open source software policy options for NASA Earth and Space Sciences](#)
 - [Open Science by Design](#)
- Community Standards and Licenses
 - [Creative Commons Zero license](#)
 - [BSD 3-Clause license](#)
 - [MIT license](#)
 - [Apache 2.0 license](#)
 - [FAIR Guiding Principles for scientific data management and stewardship](#)
 - [Open Source Initiative](#)
 - [Science Journal open source policy](#)
 - [Nature open source policy](#)
 - [AGU Data policy](#)
 - American Astronomical Society
 - [Data Guidelines](#)
 - [AAS Software policy](#)
- Existing SMD Policies and Guides
 - Earth Science

- <https://science.nasa.gov/earth-science/earth-science-data/data-information-policy>
- <https://earthdata.nasa.gov/collaborate/open-data-services-and-software/esds-open-source-policy>
- Heliophysics
 - https://science.nasa.gov/science-red/s3fs-public/atoms/files/HPD_Data_Policy_Final_20220209_TAGGED.pdf
- Planetary Data
 - <https://pds.nasa.gov/datastandards/about/>
- Citizen Science
 - <https://science.nasa.gov/science-red/s3fs-public/atoms/files/SPD-33-Signed.pdf>

Appendix B. Definitions

Archive: The process of storing data to ensure long term retention.

Accessible: As per the definition in the [FAIR](#) principles, data are retrievable by their identifier using standardized communications protocols.

Commercial Software: Software produced for the purposes of sale. This includes software that would be classified as commercial-off-the-shelf (CoTS) and software that NASA does not have a license to distribute.

Data: Scientific or technically relevant information that can be stored digitally and accessed electronically.

- Information produced by missions include observations, calibrations, coefficients, documentation, algorithms, and any ancillary information. Further definitions of mission data and examples are provided in Appendix E.
- Information needed to validate the scientific conclusions of peer-reviewed publications. This includes the data required to derive the findings communicated in figures, maps, and tables.
- This does not include laboratory notebooks, preliminary analyses, intermediate data products, drafts of scientific papers, plans for future research, peer review reports, communications with colleagues, or physical objects, such as laboratory specimens.

Data Management Plan (DMP): A document that describes whether and how data will be shared and preserved. A DMP should be compliant with NASA policies.

Findable: As per the definition in the [FAIR](#) principles, metadata and data should be easy to find for both humans and computers.

Interoperable: As per the definition in the [FAIR](#) principles, data are able to work with other applications or workflows for analysis, storage, and processing.

Open Format: A file format for storing digital data that is defined by an openly published specification, usually maintained by a standards organization and that can be used and implemented by anyone. Open file format is licensed with an open license.

Open Source Software (OSS): Software that can be accessed, used, modified, and shared by anyone. OSS is often distributed under licenses that comply with the definition of “Open Source” provided by the [Open Source Initiative](#) or meet the definition of “Free Software” provided by the [Free Software Foundation](#).

Persistent Identifier: A long-lasting reference to a digital source. The digital object identifier (DOI) system is an example of a persistent identifier.

Permissive License: Guarantees the free use, modification, and redistribution of software, while still permitting proprietary derivative works. Examples include the [Apache License 2.0](#), the [BSD 3-Clause “Revised” License](#), and the [MIT License](#).

Publication: Document released through print, electronic, or alternative media. This includes peer reviewed manuscripts, technical reports, conference materials, and books. This does not include laboratory notebooks, preliminary analyses, drafts of scientific papers or preprints, plans for future research, peer review reports, or communications with colleagues.

Report: Document produced through print, electronic, or alternative media containing scientific and technical information. These documents are typically not peer reviewed. Examples include technical publications, technical memorandums, contractor reports, conference publications, special publications, and technical translations. It does not include interim research grant reports.

Repository: An organized storage location that makes data findable and accessible.

Restricted Software: Software that shall not be released due to an existing Federal law or guidance, NASA policy, or security concern. This includes software supporting security requirements described in STD-1006. For Mission software, projects should engage with the software release authority to determine status. Examples of software that may be restricted are command related software, instrument control, authentication, or communication software.

Review: Assessment of SMD-funded activities by an individual or group. This may include a panel, standing review board, or senior review.

Reusable: As per the definition in the [FAIR](#) principles, metadata and data should be well-described so they can be replicated and/or combined in different settings. This includes releasing the data with a clear and accessible data usage policy.

Scientific Information: Scientific knowledge produced as part of a research activity. This can include, but is not limited to, publications, data, and software.

Scientific Software: Software that provides users some degree of scientific utility or produces a scientific result or service.

Scientific Utility: Information that is necessary to validate research findings or beneficial for future research activities.

Single Use Software: Software written for use in unique instances, such as making a plot for a paper or manipulating data in a specific way.

Software: Computer programs in source and object code that provide users some degree of utility or produce a result or service.

Software Project: An activity to develop software. A software project typically has a version control platform on which develop can occur collaboratively.

Source Code: A human-readable set of statements written in a programming language that together compose software. Programmers write software in source code, often saved as a text file on a computer. The terms code and source code are often used interchangeably.

Appendix C. Acronyms

AA	Associate Administrator
AAS	American Astronomical Society
AGU	American Geophysical Union
AO	Announcement of Opportunity
BSD	Berkeley Software Distribution
CAN	Cooperative Agreement Notice
DMP	Data Management Plan
DOI	Digital Object Identifier
EAR	Export Asset Regulations
FAIR	Findable, Accessible, Interoperable, and Reusable
HIPAA	Health Insurance Portability and Accountability Act
ITAR	International Traffic in Arms Regulation
MIT	Massachusetts Institute of Technology
MOU	Memorandum of Understanding
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
NRA	NASA Research Announcement
OMB	Office of Management and Budget
OPEN	Open, Public, Electronic, and Necessary
ORCID	Open Researcher and Contributor Identification
OSS	Open Source Software
OSTP	Office of Science and Technology Policy
ROSES	Research Opportunities in Space and Earth Science
SMD	Science Mission Directorate

Appendix D. Guidelines for SMD-acceptable Data Repository

Following the OSTP Desirable Characteristics of Data Repositories for Federally Funded Research, SMD data repositories should have the following characteristics:

1. **Open Accessibility:** The repository provides broad, equitable, and maximally open access to datasets and their metadata free of charge in a timely manner after submission, consistent with legal and policy requirements related to maintaining privacy and confidentiality, Tribal and national data sovereignty, and protection of sensitive data. The data will be accessible to the public (lay and scientific) without preapproval.
2. **Searchability:** The repository will ensure that data are searchable, with descriptive metadata being provided along with the data collections.
3. **Citable:** The repository will ensure that data are citable through the use of unique persistent identifiers.
4. **Curation:** The repository provides or facilitates expert curation and quality assurance to improve the accuracy and integrity of datasets and metadata.
5. **Standardization:** The repository will require that data products be submitted in standardized, discipline-appropriate formats and file types.
6. **Provenance:** The repository will ensure that data have configuration control and traceability of changes.
7. **Documentation:** The repository will include documentation for its holdings, such as a description of the data, user guides, and descriptions of any calibrations. Documentation will aspire to be broadly accessible and comprehensible to any member of the public with a college degree.
8. **Preeminence:** The repository should be considered by its user community as the “standard” repository for the subfield.
9. **Independence:** The repository should be managed separately from the individual laboratory/mission that is the major data provider.
10. **Sustainability:** The repository has plans for long-term management of the data.
11. **Retention Policy:** The repository provides documentation on policies for data retention.
12. **Authentication:** The repository supports authentication of data submitters. The repository has technical capabilities that facilitate associating submitter PIDs with those assigned to their deposited digital objects, such as datasets.
13. **Secure:** The repository has documented measures in place to meet well established cybersecurity criteria for preventing unauthorized access to, modification of, or release of data, with levels of security that are appropriate to the sensitivity of data.
14. **Risk Management:** The repository has documented capabilities for ensuring that administrative, technical, and physical safeguards are employed to comply with applicable confidentiality, risk management, and continuous monitoring requirements for sensitive data.
15. **Certified:** The properties of the repository should be certified by a recognized, independent group that will attest to the qualities of the repository.

Furthermore, repositories are preferred, but not required, to have the following features:

1. **Peer Review:** The repository should conduct independent peer reviews of data to assess usability and completeness of data packages.

2. **Public Review:** The repository should provide quality control metrics for completeness and quality. To bring in human validations, social ranking/usage of the data could substitute for peer review.

Appendix E. Levels of Mission Data

This appendix provides a description of levels of data for SMD Missions. Missions may have only a subset of these levels of data available or might have further sub-divisions of these levels, which should be indicated by a letter (e.g., Level 1b data would represent a processing stage between Level 1 and Level 2).

Data Level	Description
0	Unprocessed instrument and payload data at full resolution, with any and all communications artifacts (e.g., synchronization frames, communications headers, duplicate data) removed. This level of data may only be available upon request.
1	Reconstructed, unprocessed instrument data at full resolution, time-referenced, and annotated with ancillary information. This level of data will be in a standard format that is accessible.
2	Data that have been processed to remove instrument or sensor effects. This level of data is typically in physical units that correspond to an observable or physical quantity.
3	Data that have been mapped onto a uniform space-time grid, resampled, or combined to produce a set of data with greater completeness and consistency.
4	Products delivered as part of a Mission, derived from data. This could include model outputs, analysis of results, catalogs, or databases derived from Mission data.
5	Products contributed from the community, derived from Mission data.
Auxiliary	Technical data generated by support or other systems as part of the Mission. This could include environmental sensors, spacecraft telemetry, or other technical information. When not excepted, scientifically useful data that are produced as part of auxiliary systems should be made accessible in accordance with available resources. This level of data may only be available upon request.
Ground	Data produced on the ground for testing the Mission, either prior to launch or during operations. When not excepted, scientifically useful data produced as part of ground testing should be made accessible in accordance with available resources. This type of data may only be available upon request.

Calibration	Data generated for the calibration of scientific data. Data may be generated on-board or on the ground. These data are typically used during processing in removing instrumental effects or creating higher level data products.
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Appendix F. Guidelines for Sharing Software

Unrestricted software developed using SMD-funding is expected to be shared openly. There are many different types of software and the expectations for software sharing are different for missions and researchers.

Mission software is developed or used to support NASA’s strategic or flagship missions. This is software typically developed under NPR 7150.2 *NASA Software Engineering Requirements* or other requirements tailored for missions. Mission software is often restricted software and shall not be shared openly unless approved for release. Mission software that is not restricted shall be developed openly on a publicly accessible, version-controlled platform that allows for contributions and engagement from the community. This improves efficiency in software development, enables software reuse, and shares openly software developed using public funding. Furthermore, sharing mission software supports reproducibility for the scientific results. For missions, classification and software examples are described in NPR 7150.2 *NASA Software Engineering Requirements*, Appendix D. The following table provides guidelines for sharing different types of mission software.

Mission Software	
Software Classification	Guideline
Class A: Human Rated Space Software Systems	SMD does not support the development of human rated space software systems. This software is restricted.
Class B: Non-Human Space Rated Software Systems or Large Scale Aeronautics Vehicles	Class B includes software related to the control or command of spacecraft. This is software is typically restricted. When it is not restricted, as determined through the NASA Software Release Authority, SMD-funded Class B software shall be developed openly in a version-controlled platform.
Class C: Mission Support Software or Aeronautic Vehicles, or Major Engineering/Research Facility Software	Class C includes software related to the scientific return of a mission. This includes flight or ground software used to process or analyzed mission data, verification or testing software, or flight simulators. When it is not restricted, as determined through the NASA Software Release Authority or through a processed tailored for the Mission, SMD-funded Class C software shall be developed openly in a version-controlled platform.

<p>Class D: Basic Science/Engineering Design and Research and Technology Software</p>	<p>Class D includes secondary scientific analysis software, operational modelling software, data management tools, infrastructure tools, and scientific simulators.</p> <p>When not restricted, as determined by the Mission, SMD-funded Class D software shall be developed openly in a version-controlled platform.</p> <p>SMD-funded Class D software shall be reported to the NASA designated repository if it is not released through the NASA Software Release Authority.</p>
<p>Class E: Design Concept, Research, Technology, and General Purpose Software</p>	<p>Class E includes software produced by the mission for minor analysis of scientific or experimental results, non-operations modeling software, and infrastructure.</p> <p>Class E software developed with SMD funding will be treated as Research Software and shall be released no later than with the publication of the research. When it is not restricted, Class E software developed with SMD funding not related to a publication shall be developed openly in a version-controlled platform.</p> <p>Class E software developed with SMD-funding shall be reported to the NASA designated repository if it is not released through the NASA Software Release Authority.</p>
<p>Class F: General Purpose Computing, Business, and IT Software</p>	<p>Class F software is typically commercial or enterprise software. Commercial or enterprise software is not expected to be shared.</p> <p>If Class F software is developed as part of the mission, that software shall be shared openly if it is not sharing restricted information (e.g., budgetary or personal information) or release is restricted due to other concerns such as security.</p>

Missions are encouraged to directly contribute to open source software projects to support the mission and benefit the community. Restricted information or software should never be contributed.

Research software is software produced by investigations funded via research awards. This software should be developed and released as described in the project’s software management plan. Scientifically useful software developed under a research award shall be released no later than the time of publication or at the end of the research award. Restricted software (e.g., license restrictions or patent protections) should be discussed with the program officer, as restricted software does not have to be released. The release of research software improves the

reproducibility of the research, along with enabling other scientists to use and build on the software that was developed using public funds. The following table provides guidelines for sharing different types of research software³¹.

Research Software	
Software Type	Guideline
Single Use Software	<p>Software written for use in unique instances, such as making a plot for a paper or manipulating data in a specific way.</p> <p>Single-use software developed from SMD-funding shall be released no later than with the publication it supports. It can be released as supplementary material to the publication or shared in a data repository that produces a permanent identifier that is linked to from the publication.</p>
Libraries	<p>Generic tools, often with a larger user base, implementing well-known algorithms, providing statistical analysis or visualization, etc., that are incorporated in other software categories.</p> <p>Libraries developed using SMD funding shall be released no later than the publication it supports. Libraries should be developed openly in a version-controlled platform and SMD-funded researchers are encouraged to contribute to existing, open source libraries. Major versions or releases of the software should be archived in a NASA designated repository.</p>
Analysis Software	<p>Generalized software (not low-level libraries) used to manipulate measurements or model results to visualize or gain understanding. This software often evolves from single-use utility software and may incorporate libraries.</p> <p>Analysis software developed from SMD-funding shall be released no later than the publication it supports. Analysis software should be developed openly in a version-controlled platform and SMD-funded researchers are encouraged to contribute to existing, open source analysis software. Major versions or releases of the software should be archived in a NASA designated repository.</p>
Model and Simulation Software	<p>Software that either implements solutions to mathematical equations given input data and boundary conditions or infers models from data. Includes first-principles models, data-assimilation tools, empirical models, machine learning, mission planning and engineering tools, among others. They often use libraries.</p>

³¹ [Open source software policy options for NASA Earth and Space Sciences](#)

	<p>Model and Simulation software developed from SMD funding shall be released no later than the publication it supports. Model and Simulation software should be developed openly in a version-controlled platform and SMD-funded researchers are encouraged to contribute to existing, open source software. Major versions or releases of the software should be archived in a NASA designated repository.</p>
<p>Data Processing</p>	<p>Software for processing uncalibrated sensor measurements into calibrated sensor data and derived data products. This software type applies calibration coefficients, corrections or algorithms, which may be dependent on forward modeling, simulated observations, equations, and data filtering. It may include modeling and simulation software and libraries.</p> <p>Data processing software developed from SMD funding shall be released no later than the publication it supports. Data processing software should be developed openly in a version-controlled platform and SMD-funded researchers are encouraged to contribute to existing, open source software. Major versions or releases of the software should be archived in a NASA designated repository.</p>
<p>Commercial Software</p>	<p>Software produced for the purposes of sale. This includes software that would be classified as commercial-off-the-shelf (CoTS) and software that NASA does not have a license to distribute.</p> <p>Commercial software is not required to be released.</p> <p>SMD-funded research software developed in a commercial language (a programming language that requires a license to compile or run software) is not considered commercial software and shall be shared in a similar manner as other types of software developed in open languages.</p>