

National Aeronautics and
Space Administration



Open-Source Science at NASA

Airborne Data Workshop
March 30, 2022

A decorative graphic on the left side of the slide, featuring a curved white border. Inside the border, there is a space-themed scene with a bright sun in the bottom left, the Earth's horizon, and several other celestial bodies including Saturn, Mars, and the Moon against a starry blue and green background.

Outline

- Overview of NASA's Open Science policies and ongoing initiatives
- What does this mean for ongoing work?
- What does this mean for future work?

A decorative graphic on the left side of the slide, featuring a curved white border. Inside the border, there is a space-themed background with a blue and green nebula, a bright yellow sun, and several planets, including Saturn with its rings, Mars, and a crescent moon.

What is Open Science?

We define **Open Science** as:

a **collaborative culture enabled by technology** that empowers the **open sharing of data, information, and knowledge** within the **scientific community and the wider public** to accelerate scientific research and understanding.

What is Open-Source Science?

Open-Source Science is NASA's method for putting Open Science into practice.

- Opening the entirety of the scientific process, from start to finish
- Community involvement in the scientific process and development of best practices
- Openness and accessibility of data, software, and publications to facilitate inclusion, transparency, and reproducibility

Open-Source Science Principles



Open (Transparent) Science
scientific process and results should be visible, accessible, and understandable

Open (Accessible) Science
data, tools, software, documentation, and publications should be accessible to all (FAIR)

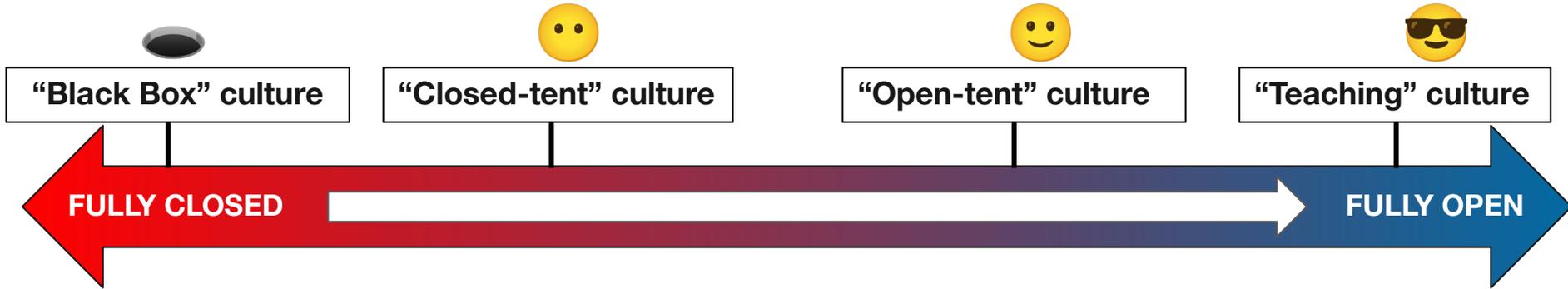


Open (Inclusive) Science
process and participants should welcome participation by and collaboration with diverse people and organizations

Open (Reproducible) Science
scientific process and results should be open such that they are reproducible by members of the community



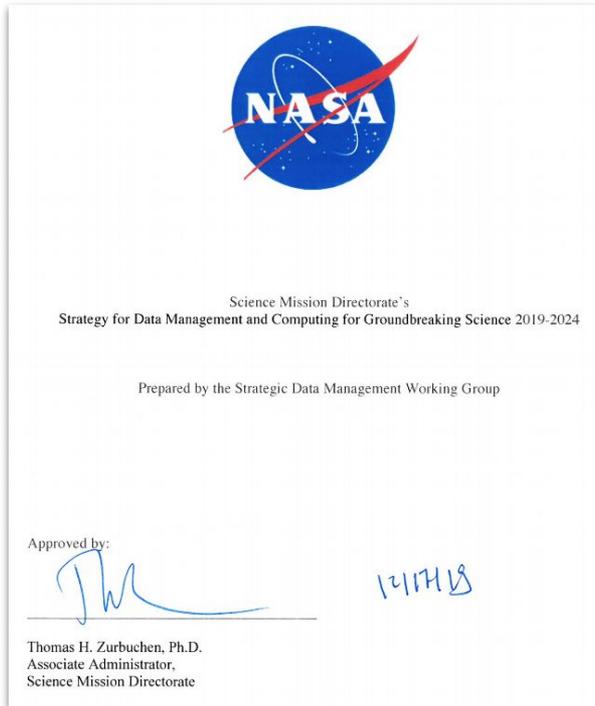
Open-Source Science Continuum



An open scientific "teaching" culture is self-perpetuating and based in an active, participatory open-source community, **but this does not mean that it is "free"**.

Open Science requires financial support and incentives from funding agencies.

What is the SMD Strategy for Data and Computing?



An SMD-approved strategy to enable transformational open science through continuous evolution of SMD's science data and computing systems.

Goal 1: Develop and Implement Capabilities to Enable Open Science

Goal 2: Continuous Evolution of Data and Computing Systems

Goal 3: Harness the Community and Strategic Partnerships for Innovation

What is NASA's Open-Source Science Initiative (OSSI)?

OSSI aims to implement **NASA SMD's Strategy for Data and Computing**

OSSI is a comprehensive program of activities to enable and support moving science towards openness, including:

- policy adjustments
- supporting open-source software
- enabling cyberinfrastructure.

What is the Scientific Information Policy (SPD-41)?

SPD-41 brings together existing NASA and Federal guidance on open data, software, and publications.

SPD-41 applies to all new SMD-funded activities related to producing scientific information. (start date September 2021 and later)

[SPD-41: The Science Information Policy](#)

“As open as possible, as closed as necessary.”

What is “NASA Scientific Information”?

Publications

Scientific & technical documents, including information produced during public meetings, released through print, electronic, or alternative media.

Data

Scientific information that can be stored digitally and accessed electronically.

Software

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

SPD-41 Policy

Data

Scientific data shall be made publicly available with a clear, open, and accessible data license no later than the publication of the research.

Mission data shall be openly available with no period of exclusive access.

Software

Research software should be publicly available no later than the publication of the research and assigned a permissive software license.

Publications

Manuscripts versions of as-accepted manuscripts shall be deposited in a NASA repository and made publicly available within 12-months.

Mission publications shall additionally be made publicly available at the time of their publication.

SPD-41a Policy (**updates** to SPD-41 under consideration)

Data

Scientific data **should be FAIR** and shall be made publicly available with a clear, open, and accessible data license no later than the publication of the research, **and be citable**.

Mission data shall be openly available with no period of exclusive access.

Software

Research software **shall** be publicly available no later than the publication of the research, assigned a permissive software license, **and be citable**.

Mission software shall additionally be developed openly in a publicly accessible, version-controlled platform that allows for contributions and engagement from the community.

Publications

Manuscripts versions of as-accepted manuscripts shall be deposited in a NASA repository and made publicly available within 12-months. **Publishing as open access is supported and posting preprints is encouraged**.

Mission publications shall additionally be made publicly available at the time of their publication.

Science workshops and meetings shall be open to broad participation and documented in public repositories.

Open science activities will be considered in reviews of proposals.

Open-Source Science Policy for Earth Science Missions

- A. All mission data, metadata, software, databases, publications, and documentation shall be available on a full, free, open, and unrestricted basis starting in Phase B with no period of exclusive access.
- B. Science workshops and meetings shall be **open** to broad participation and documented in public repositories.

1 Software shall be developed **openly** in a publicly accessible, version-controlled platform using a **permissive software license allowing for community use and contributions**.

4 Scientific data, metadata, software, publications and documentation shall be **archived and made available by NASA and/or [Partner] starting in Phase B**.

2 Manuscripts shall be published with **open access licenses**; versions of as-accepted manuscripts shall be made available as open preprints and deposited in a NASA or [Partner] **repository upon publication**.

5 NASA and [Partner] software, documentation and data shall be **properly marked, cited, and/or attributed**. Metrics to measure and acknowledge open-source science contributions will be developed.

3 All mission **data, calibration information, and simulated products supporting development and validation of algorithms shall be made available without any conditions to use**.

6 NASA and [Partner] will **mutually develop an Open-Source Science Plan** that specifies details of collaboration.

Collaborative, accessible, inclusive, transparent, and reproducible from the beginning.

What is Transform to Open Science (TOPS)?

TOPS is a 5-year NASA Science Mission Directorate initiative.



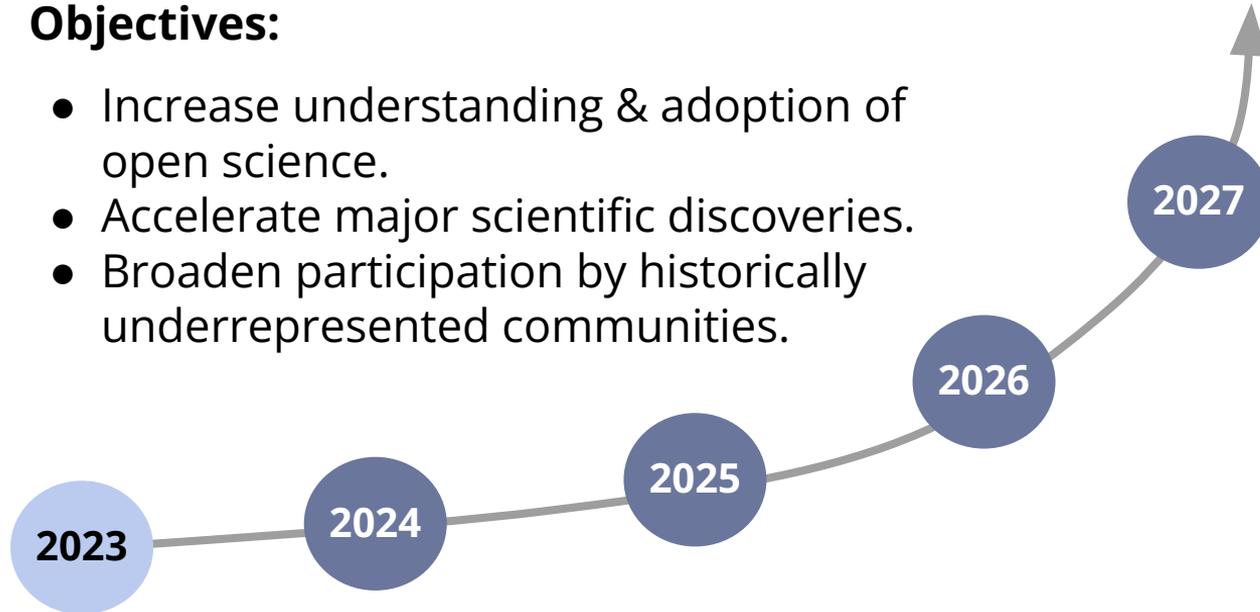
Objectives:

- Increase understanding & adoption of open science
- Accelerate major scientific discoveries
- Broaden participation by historically underrepresented communities

TOPS: Leading the Path to Open-Source Science

Objectives:

- Increase understanding & adoption of open science.
- Accelerate major scientific discoveries.
- Broaden participation by historically underrepresented communities.



**Year of Open
Science**

Goals for 2027:

- 20K earn Open Science Badge
- 5+ major discoveries
- Increased participation of underrepresented groups by 2x

What does this mean for ongoing work?

SPD-41 is not an unfunded mandate.

While existing Missions and projects are encouraged to adopt open science principles as it is possible to do so, this is voluntary.

The development of these policies does not change the terms of existing contracts with NASA.



What does this mean for future work?



Future NASA-funded Missions and projects will be required to comply with NASA's Open-Source Science policies.

This compliance will be **supported by funding and incentive structures** designed to facilitate a large-scale transition into adoption of Open Science principles.

What should I look out for?



- **Supporting policy information**
Division-specific documents describing “how” SPD-41 should be implemented
- **Capacity-building:**
Guidance for open source software and open meetings; Open Science courses and certifications from TOPS