

National Aeronautics and  
Space Administration



# NASA's Year of Open Science

## NASA Science Mission Directorate (SMD)

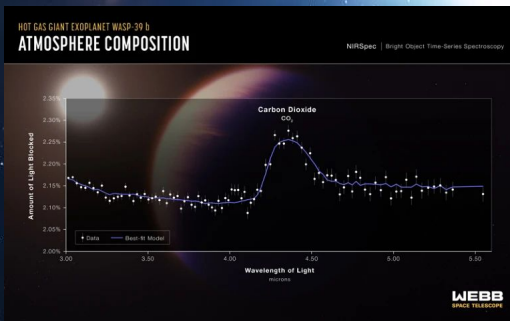
Kevin Murphy, Chief Science Data Officer SMD  
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LPSC  
13 March 2023



# Accelerating Science:

Detecting CO<sub>2</sub> in the atmosphere of an exoplanet



<https://www.nature.com/articles/d41586-022-02350-2>



James Webb Space Telescope  
Early Release Science Program



First Video of NASA's Ingenuity Mars Helicopter in Flight, Includes Takeoff and Landing (High-Res)



Watch later



Share



0:00 / 0:57



YouTube



# Paid journals? How open is this science?



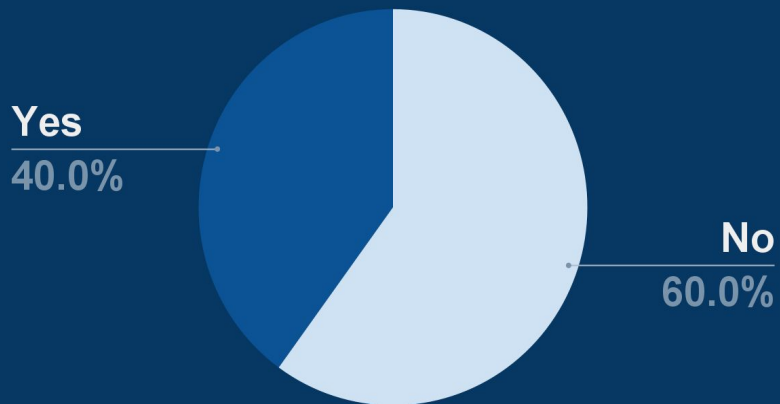
Access to journals worldwide via paid licenses



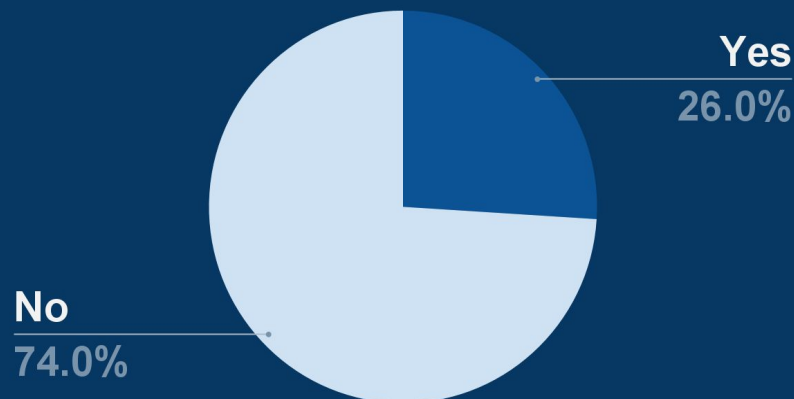
## Can we build on and extend results?

2011: AAAS Science Journal policy requires sharing data & software upon request; in 2018 tested 204 scientific papers after policy implemented:

### Data Made Available?

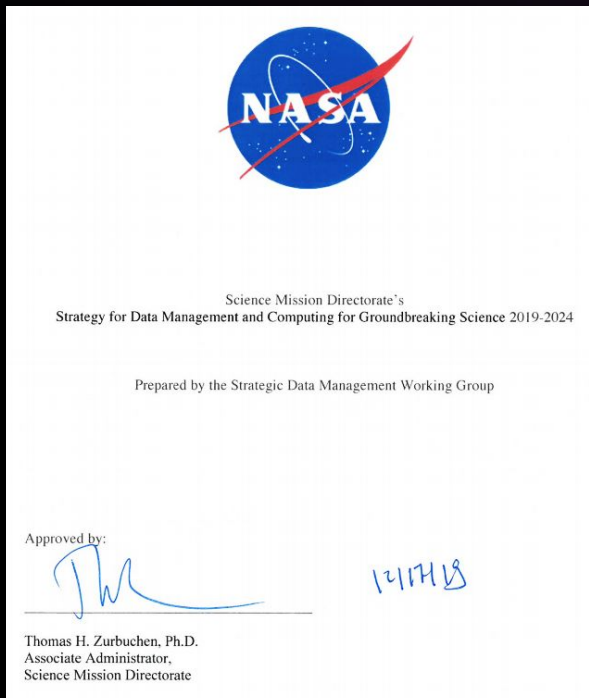


### Reproduce results?



<https://www.pnas.org/doi/full/10.1073/pnas.1708290115>

# 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



# Open Science

Open science is the principle and practice of making research products and processes available to all, while respecting diverse cultures, maintaining security and privacy, and fostering collaborations, reproducibility and equity.



# Open-Source Science is NASA's method to put Open Science into practice

- **Open** the entirety of the scientific process, *from start to finish*
- **Broaden** community involvement in the scientific process
- **Increase** accessibility of data, software, & publications
- **Facilitate** inclusion, transparency, and reproducibility of science





A graphic for the 'Policy' section featuring a large grey padlock icon in the center. The background is dark blue with various white icons: a globe, a server rack, a fingerprint, a gear, and a Wi-Fi symbol, all connected by dotted lines. A stylized Earth globe is visible at the bottom.

**Policy**

A graphic for the 'Infrastructure' section featuring a blue cloud icon with a grid of small squares inside it. The background is dark blue with a pattern of glowing blue squares and a horizontal light blue glow at the bottom.

**Infrastructure**

A white circular logo containing the text 'NASA's Open-Source Science Initiative' in black, bold, sans-serif font.

**NASA's  
Open-Source  
Science  
Initiative**

A graphic for the 'Funding' section featuring a dark blue background with a pattern of glowing white squares and lines, resembling a circuit board or data flow.

**Funding**

A graphic for the 'Community' section featuring a dark blue background with a starry space scene and a network of glowing blue lines on the right side.

**Community**



# SPD-41a is SMD's updated Scientific Information Policy.

- SPD-41a updates the previously released SPD-41, which consolidated existing Federal and NASA policy on sharing scientific information.
- SPD-41a is *forward looking* and will apply to all future SMD-funded scientific activities
- Policy updates were developed with community input and based on the OSTP Memo on Ensuring Free, Immediate, and Equitable Access to Federally Funded Research

## Major Policy Updates

- Peer-reviewed publications are made openly available with no embargo period.
- Research data and software are shared at the time of publication or the end of the funding award.
- Mission data are released as soon as possible and unrestricted mission software is developed openly.
- Science workshops and meetings are held openly to enable broad participation.

[Scientific Information Policy Website & FAQ](#)





# SPD-41a aims to maximize openness while minimizing burden on SMD-funded missions and researchers.

**Support from NASA's Open-Source Science Initiative includes:**

Open-Source Science  
Guidance for  
SMD-funded  
researchers

Scientific Information  
Policy FAQ

Outreach and  
Training:  
Transform to  
Open Science



Infrastructure: core  
services for cataloging,  
search and discovery,  
and computing

Funding opportunities  
to support the adoption  
of open-source science  
practices

All resources are  
linked on the [Scientific  
Information Policy  
Website](#)



## Exclusive Use in SPD-41a

- SPD-41a applies to new missions; exclusive use periods on existing missions (e.g., Hubble, Chandra, JWST) will be discussed on a case-by-case basis.
- SPD-41a does not take precedence over existing international agreements for missions like the James Webb Space Telescope that set a period of exclusive use for targeted observations, and any changes to those agreements will take place in consultation with our partners.
- The first variance for SPD-41 allows PI/project scientist to adjust exclusive use period in exceptional circumstances (e.g., to protect the timely completion of a graduate student's thesis).



## Exclusive Access in SPD-41a

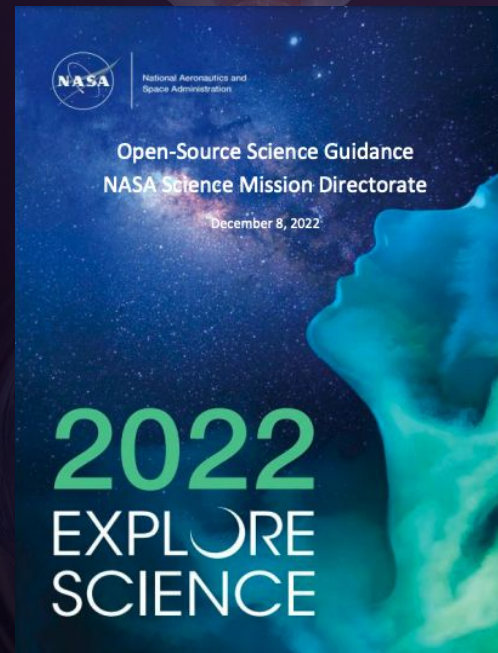
“There shall be no period of exclusive access to Mission data. A period after the data have been obtained may be allowed for activities such as calibration and validation of the data. This period shall be as short as possible and shall not exceed six months.”

- This period provides researchers time to validate the scientific quality of their targeted observations and experiments.
- SPD-41a also includes a process for variances when a longer period of time for calibration and validation is warranted for data from missions for exceptional reasons.



# Open-Source Science Guidance

- Narrative guidance on how to comply with SPD-41a; options and examples
- High-level, for relevance across SMD Divisions
- Adopts guidance published by other agencies
- Living document to be developed over time
- Contains:
  - Background and Motivation
  - Open Science and Data Management Plan
  - Sharing Publications
  - Data Management and Sharing
  - Software Management and Sharing
  - Sharing Materials for Science Events
  - Glossary of Open-Source Science Terms





# STI Program: PubSpace and CHORUS Updates

NASA's [PubSpace](#) was officially re-launched as part of the [NASA STI Repository](#) on November 17<sup>th</sup>, 2022, serving as NASA's designated public access repository. The PubSpace Collection currently features:

- **Over 29,000 metadata records** with links to publisher websites ingested from CHORUS resources and
- **10,132 full-text journal articles** directly submitted through STRIVES.

NASA-funded content from the National Institutes of Health's (NIH) PubMed Central (PMC) will soon be discoverable in the collection.

- [NASA's portal](#) to the National Institutes of Health's (NIH) PubMed Central (PMC) repository of journal articles from NASA-funded research remains accessible.

NASA entered into a partnership agreement with [CHORUS](#), allowing NASA-funded authors to more easily satisfy the [Agency's requirements for public access](#) when the publisher is a member of CHORUS.

- For more information on how to make your publication available in PubSpace, please see the STI Program's [Submit to PubSpace page](#).
- Currently assessing impacts of recent OSTP memo provisions on NASA policy and implementation strategies

The CHORUS Dashboard service allows users to keep track of open access compliance by [CHORUS publisher members](#). NASA's dashboard can be found via [this link](#).





# NASA Open Science Funding

## F.2 Topical Workshops, Symposia, and Conferences

Events, Hackathons, un-conferences, and challenges that build open science skills, Training in open science. Rolling deadline.

## F.7 Support for Open Source Tools, Frameworks, and Libraries

Support and maintain open source tools, frameworks, and libraries that are significantly used by the SMD community. \$2M awarded in ROSES20 to 8 programs. Once every 3 years

## F.8 Supplemental Open Source Software Awards

Supplemental award to encourage the conversion of legacy software to open source. \$200K awarded in ROSES20 to 6 awards. Yearly, \$250K available, rolling deadline.

## F.14 Transform to Open Science Training

Tutorials showcasing open science in action and NASA cloud data, summer schools, virtual cohorts. Budget of \$4.5M per year in ROSES 22. Once every three years.

## F.15 High Priority Open-Source Science

Supporting innovative open source tools, software, frameworks, data formats, and libraries. Budget ~\$1M. Yearly, rolling deadline.

## F.16 Supplement for Software Platforms

Supplemental support to existing awards for usage of scientific platforms. Budget TBD.







# Infrastructure: Core Services

## Science Discovery Engine

Develop and implement an SMD data catalog to support discovery and access to complex scientific data across Divisions.

## Science Explorer

Extend the primary digital library portal for researchers in astrophysics, planetary science & heliophysics, the Astrophysics Data System (ADS), to support Earth and Biological and Physical Sciences

## Data and Computing Infrastructure

On-going Data & Computing Architecture study to identify scientific data and computing capabilities and architectures that enable Open Science.

**RFI closed Feb. 21**





# NASA Community Engagement

NASA's Transform to Open Science (TOPS) is a \$40 million 5-year mission to accelerate adoption of open science

## TOPS' Strategic Goals:

- Support 20K researchers to earn NASA's open science badge
- Double the participation of historically excluded groups across NASA science
- Enable five major scientific discoveries through open science principles



**Engagement**



**Capacity Sharing**



**Incentives**



**Coordination**



*Join us as we embark on A Year of Open Science with NASA TOPS!*



# NASA's 2023 Year of Open Science



## TOPS Priorities:

...is the spark

### CURRICULUM - Introduction to open science

- 1000 scientists earn NASA TOPS open science certificates

### EVENTS - Engage historically underrepresented groups

- Partner w/ Minority Serving Institutions (MSIs) for marquee events, TOPS Annual Hackathon, Annual TOPS Internship program (3-4 people/year; All-in)
- Establishing Strategic Partnerships with external organizations focused on STEM engagement

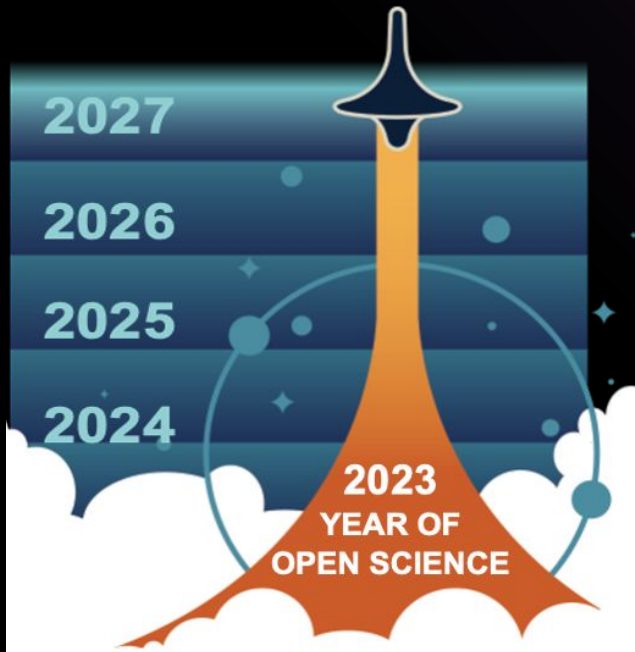
### OPPORTUNITIES - Develop incentives

- Pilot including open science activities in evaluations of 5+ NASA ROSES23 elements and at 5+ universities (Tenure and Promotion)
- Partner with societies on open science awards



# TOPS is Increasing Understanding and Adoption of Open Science

Developing the infrastructure to train 20,000 scientists and researchers as part of our five-year mission



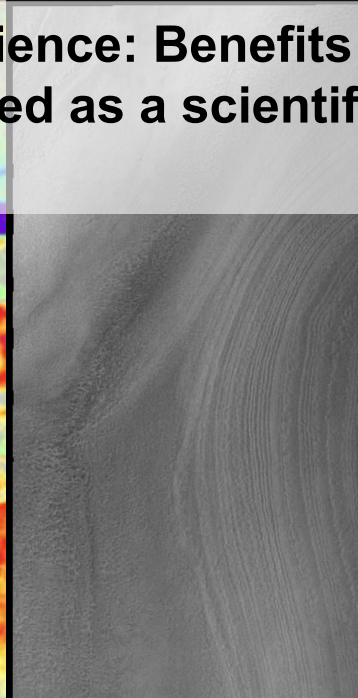
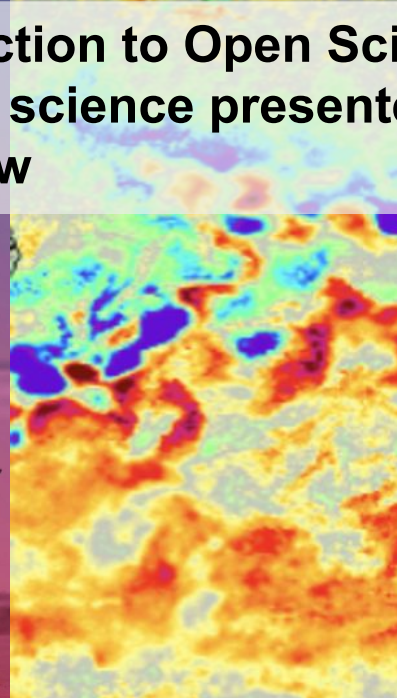
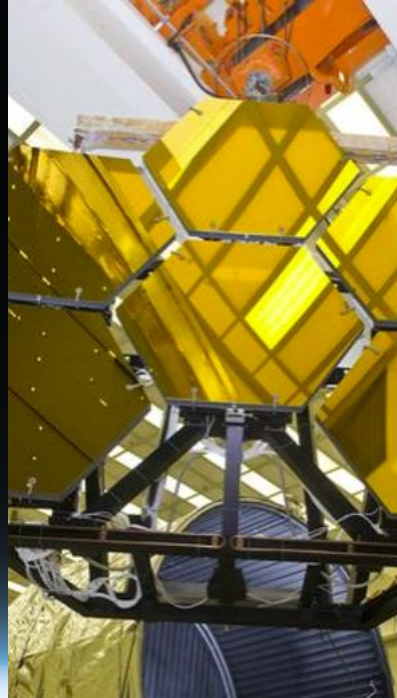
- Introduce those beginning their open science journey to important definitions, tools, and resources
- Provide participants at all levels recommendations on best practices from subject matter experts

**Earn NASA Open Science Certification**





# Introduction to Open Science: Benefits of open science presented as a scientific workflow



**Ethos of Open Science**

**Open Science Tools**

**Open Source Software**

**Open Data**

**Open Results**



# The NASA Open Science Certificate indicates researchers have key open science skills



- Able to use digital tools to perform open science (e.g., ORCID, Zenodo, Github accounts)
- Familiar with data management and software management plan best practices and resources
- Grow connections across a community of open science practitioners

*A community developed introduction to open science with inclusivity, accessibility, and diversity at the forefront.*



# In-person Workshops

- HQ workshops
- NASA Centers
- Conferences
  - EGU, AAS, IGARSS and more
- TOPST Virtual & summer schools
  - Starting 1 June
  - Research community & NASA science teams

#	Status
~350	Completed OS101A
~1575	Signed up OS101



# Get NASA Open Science Certified!

## Take the first module at LPSC!

3/14 Tues

9:00 - Noon or 2:00 - 5:00

3/15 Wed

8:00 - 11:00 or 2:00 - 5:00





# Open Science 101 Future Offerings

Modules 1-5  
In-person and Online  
this summer



Provide your email here to  
receive updates of  
Open Science 101 Workshops





# TOPS Presence during Year of Open Science - Society Engagement



Conference	Date	Size	BPS	PDS	Helio	Earth	Astro	HUGS*
AGU Fall	Dec	25K	x	x	x	x	x	
AMS	Jan	6K			x	x		
AAAS	Mar	9K	x	x	x	x	x	
LPSC	Mar	2K		x				
EGU	Apr	18K	x	x	x	x	x	
AAS	Jun	3K		x	x		x	
IGARSS	Jul	3K				x		
SASE	Oct	3K						x
Amer. Indian Sci.& Eng	Oct	2K						x
SACNAS	Oct	6K						x
ASGSR	Nov	1K	x					
AGU Fall	Dec	25K	x	x	x	x	x	
Targeted workshops	May/Sep	200						x
<b>Totals</b>		<b>~100K</b>	<b>5</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>5</b>	<b>4</b>

\*HUGS- Historically Underrepresented Groups



# There are actions you can take today to get more involved in open science!

And help others get involved, too!

**Join an Open Science Community!**



**Develop an Open Science Action Plan**



**Highlight your Team's Open Science Success Stories**

**Learn more about TOPS Open Science Activities!**



# The White House announces A Year of Open Science



Along with other organizations,  
including HELIOS, a coalition of  
80+ universities



# A Year of Open Science

## GOALS FOR PARTICIPATING FEDERAL AGENCIES

1. Establish **strategic approaches** for advancing equitable open science
2. Promote equitable participation in open science through transparency, integrity and equity of **reviews**
3. Account for **open science activities** in evaluations and incentives
4. **Engage** underrepresented communities in the advancement of equitable open science and research







# NASA is looking ahead at really big challenges

“We need more WE science rather than ME science.”

- Harlan Krumholz,

Yale School of Medicine at 2022 CZI Meeting

Dimorphos  
HST WFC3/UVIS  
F350LP

Join us in advocating for the open sharing of data, software and results!

Credit: Science: Nasa, ESA, Jian-Yang Li (PSI); animation: Alyssa Pagan (STScI)



# We need YOU!

National Aeronautics and  
Space Administration

