

Transforming to OPen Science

to change everything, we need everyone



A NASA OPEN SOURCE SCIENCE INITIATIVE:
TOPS: TRANSFORM TO OPEN SCIENCE

- > WE HAVE LOST THE LUXURY OF TIME
- > COVID-19, CLIMATE CHANGE, ...
- > THE WORLD IS CHANGING RAPIDLY
- > SCIENTISTS MUST ADAPT

“We need every solution and every solver. As the saying goes, to change everything, we need everyone. What this moment calls for is a mosaic of voices-- the full spectrum of ideas and insights for how we can turn things around.”

Ayana Elizabeth Johnson and Katharine Wilkinson (Eds.). [All We Can Save](#): Truth, Courage, and Solutions for the Climate Crisis. 2021.

Why are we here?

We have to tackle a really hard problem:
changing the cultural norms that are preventing us from embracing new ideas, truly working together and moving forward.

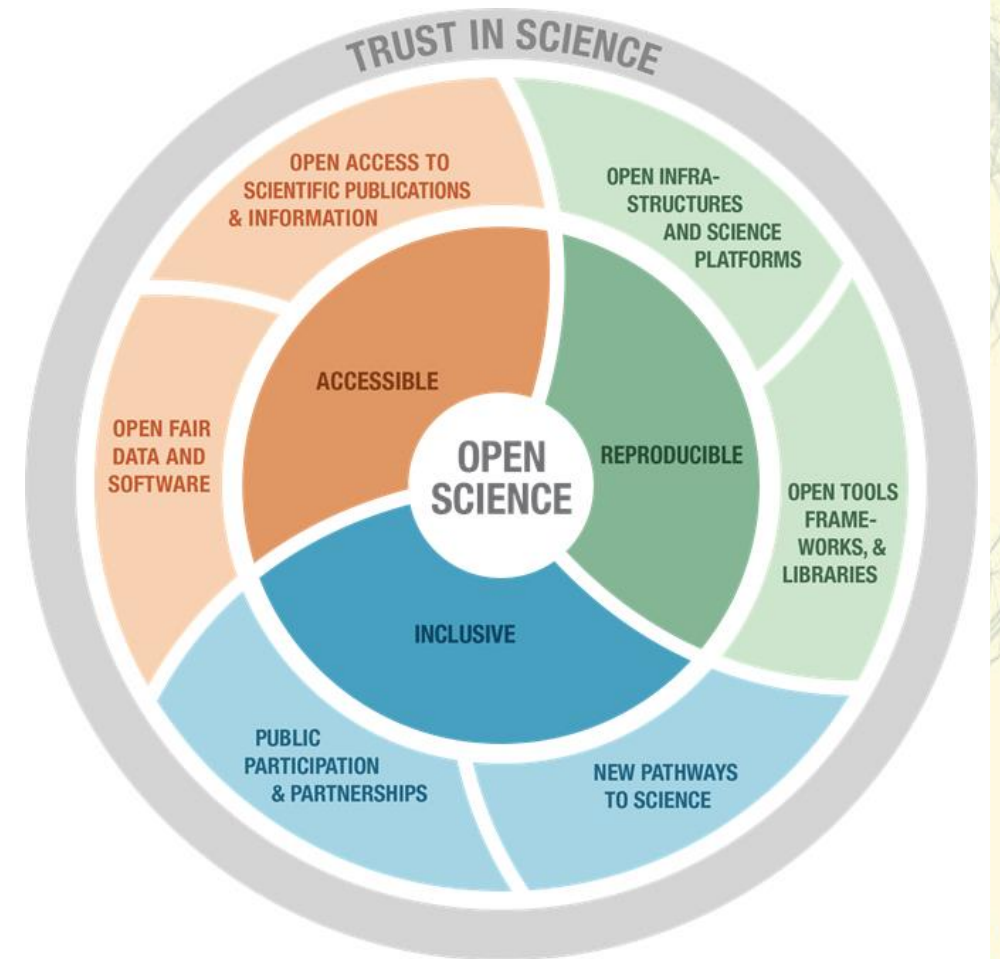
It isn't enough to talk about diversity and strengthen policies that foster inclusivity - we must change the power dynamics that disempowered and excluded people



What is open science?

Open Science Establishes Continued Trust in Science :

- Accessible: open data, open software, open information
- Reproducible: Make sharing and collaborating more efficient by supporting open software tools, frameworks, libraries, and open infrastructures
- Inclusive: innovative pathways to participation and expand public/private partnerships



Open knowledge → Better data → Better science → Bigger impacts

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Why do open science?

How:

- Open, transparent, collaborative, and inclusive scientific practices
- More accessible & verifiable scientific knowledge subject to scrutiny and critique

Results:

- Increases trust in science
- More efficient enterprise
- Improves quality
- Improves reproducibility
- Expands the impact of science
- Provides robust evidence for decision-making and policy
- Creates new pathways for participation
- More equitable

Sharing hidden knowledge



Image credit: Twentieth Century Fox

Why transform now?

Current challenges:

- Climate change
- Protecting our interconnected world from extreme space weather events
- Identifying threats from interplanetary space
- Searching for life beyond Earth
- Unlocking the secrets of the Universe

What are we going to do about it?

- Recognize the transformative potential of open science to reduce inequalities AND advance science



Image credit: NOAA

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How is **NASA's Science Mission Directorate** going to respond?



Accelerating Scientific Discovery

These activities are designed to **support and strengthen** other NASA SMD initiatives on Inclusion, Diversity, Equity, and Accessibility (IDEA) and work for environmental justice.

Overview

- TOPS 5-year initiative will act as a catalyst to **jump-start** a suite of coordinated activities designed to rapidly transform science
- Designate **2023 as the Year of Open Science (YOOS)**

Goals

- Promoting a **common understanding** of open science, associated benefits and challenges, as well as diverse paths to open science.
- Investing in human resources, education, digital literacy and **capacity sharing** for open science.
- Fostering a **culture** of open science and aligning incentives for open science.
- Promoting innovative **approaches** for open science at different stages of the scientific process.
- Promoting international and multi stakeholder **cooperation** in the context of open science and in view of reducing digital and knowledge gaps.

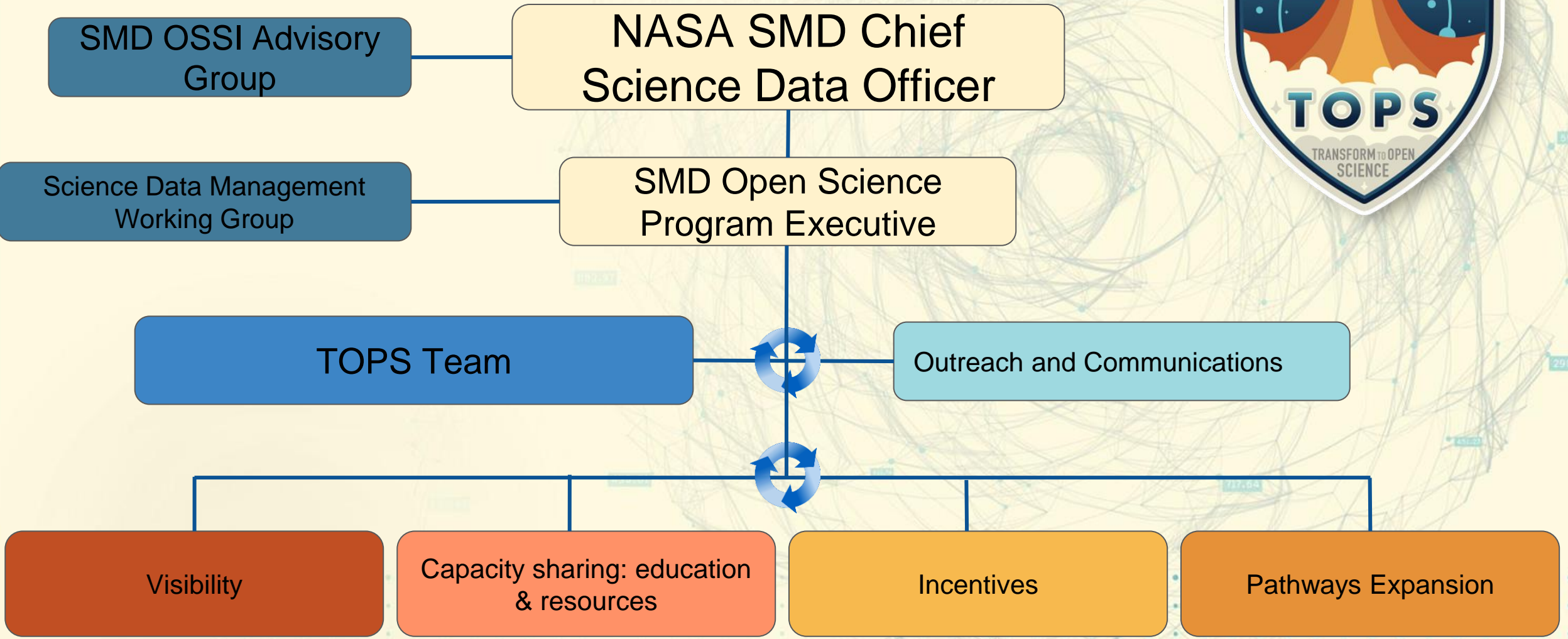
Key Performance Indicators for TOPS

In 5 years, TOPS will:

1. **Increase understanding and adoption of open science principles and techniques in our Mission and Research Communities**
 - a. 75% of mission and research principal investigators certified in open science principles
 - b. 20K scientists achieve open science certification
2. **Accelerate major scientific discoveries through supporting the adoption of open science**
 - a. One major scientific discovery using open science methods supported in each division (5 community moon shots) within 5 years
3. **Broaden participation by historically excluded communities**
 - a. Double participation by historically excluded communities in submitted proposals, applications from students, and participation in mission teams.



TOPS organizational structure



Areas of Action

Visibility

A lack of high-level support has left many scientists unsure about whether they are even 'allowed' to share knowledge and how moving to open science may impact their careers and funding.

- Promote 2023 - Year of Open Science (YOOS)
- Publish articles about TOPS and open science
- Build partnerships with scientific organizations to hold open science learning events at their annual meetings
- Provide visibility to solutions that advance adoption of open science
 - Eg. Software Release Agreements / tenure evaluations / award criteria
- Highlight open science success stories



Areas of Action

Capacity sharing: Learning resources and activities

Goal: 20K scientists & 75% PIs move to open science practises.

- Interactive open science platform populated by curated content that can be taught in-person or remote.
 - Build on existing resources to advance literacy in open source science methods, data science, tools and practices
 - Open data science events at annual meetings
 - Dedicated open data science summer schools
 - Open science cohorts
 - Open science events throughout year
 - Massive open online courses (MOOCs)



Areas of Action

Incentives

Reward and recognize 'the work'

- NASA Open Source Science Awards program
- Open science certifications / badges
- Prizes and challenges and cross-division science use cases, (eg. SpaceApps type events)
- Open science activities recognized in NASA reviews
- Support opening domain-specific course materials
- Support open learning resources
- Support to attend TOPS activities and events



Areas of Action



Pathways expansion

Double participation by historically excluded groups. Prioritize true change, collaborate with excluded communities to co-develop opportunities.

- New resources and opportunities for learning and participating in open science
 - Expand accessibility to free and open science research infrastructures
 - Leverage Public Participation and Partnerships
 - Host environmental justice targeted data science events
 - Invest in summer schools
- Engagement with historically excluded communities
 - Building partnerships with HBCU/MSI/HSI/TCU
 - Opening up hidden knowledge
 - Collaborative resource development
 - Funding (with mentorship) to attend TOPS activities and science meetings
 - Strengthen support for English as Second Language learners

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Next Steps

- > Prepare for 2023 YOOS
- > Visibility
- > Co-develop learning resources
- > Incentives program
- > Expand pathways & build partnerships
- > Support open science
- > Plan open science events

<https://github.com/nasa/Transform-to-Open-Science>