October 2022 NASA Transform to Open Science (TOPS) Community Panel Summary Report

1) Confirm your author orcids here.

2) Key Findings - Summary of project and results (1 Page)

a) High-level objective and goals of participation
b) Effectiveness of TOPS strategies for advancing project goals
c) Describe the key attributes/qualities of the TOPS strategies that were primary driver(s) of your assessment

3) Day 1: TOPS Year of Open Science Strategy and Community Development

TOPS is a 5-year, $40 million, NASA-funded Open-Source Science Initiative (OSSI) to make science more accessible, r/eproducible, and inclusive. This initiative joins other projects in open science[1].NASA recognizes that moving toward openness will require a culture shift within the scientific community toward transparency and collaboration. TOPS reflects NASA's effort to foster adoption of open science and capitalize on global momentum to make the shift to open science a reality.

Open science means different things to different communities. TOPS encourages a definition of open science that is Findable, Accessible, Interoperable, and Re-usable (FAIR). Open science enables transparent and collaborative scientific practices, opens up hidden knowledge, promotes equitable approaches, and actively works to broaden participation especially from those from systematically marginalized and under-represented groups in scientific institutions (while acknowledging that what constitutes under-representation can be context-dependent). We recognize that open science is a continuum of various practices and that we need more people with diverse experiences to participate so that we can ask better, more relevant questions in science and develop solutions. Importantly, we now have the technology, tools and involvements from various stakeholders from different sectors to realize the full potential of open science.

TOPS has set ambitious goals for this program including to produce five major scientific discoveries through open science practices, double participation by

[1] Open science is the movement to make scientific research (including publications, data, physical samples, and software) and its dissemination accessible to all levels of society, amateur or professional. (Wikipedia, Open Science)

systematically marginalized and underrepresented communities, and train 20,000 members of the science community in open science.

The open science movement also focuses on policy and compliance tools, core services for science discovery, funding elements, and community-building partnerships. To realize these goals, TOPS focuses on four key areas:

1) Community Engagement/Visibility: high-level support and visibility for initiatives that is focused on building local communities
2) Capacity Building: free public OpenCore curriculum available through Open edX
3) Meaningful Incentives: prizes, certifications, and awards for leadership
4) Moving Toward Openness: open meetings, the 2023 Year of Open Science

In 2023, TOPS will focus on:

1) Engagement through community building activities such as, a presence at major science meetings, working with STEM communities to empower open science efforts and co-develop resources, and holding community forums monthly for feedback.
2) Capacity Sharing through the development and launch of the OpenCore curriculum
3) Research Opportunities in Space and Earth Sciences (ROSES) solicitations

There is already a Zenodo group for outputs related to TOPS: https://zenodo.org/communities/tops.

Strengths:

a) The TOPS team is attending national and international conferences, giving talks/presentations and increasing the visibility of TOPS
b) Building and growing the TOPS community through online engagements: social media, blog posts, community forum-related activities and direct collaboration.
c) TOPST (Transform to OPen Science Training) and other ROSES solicitations
d) Holding monthly community forums to share TOPS resources and activities regularly
e) Publishing outputs as they occur, such as via Zenodo and GitHub with CC-BY licenses to facilitate sharing and translations.

Weaknesses:

a) Need more partnerships with other organizations doing open science in the USA such as National Science Foundation (NSF) and National Institutes of

Health (NIH), and internationally such as UNESCO and Centre National de Recherche Scientifique (CNRS)

b) Need to define how we measure success in open science
c) No clear definitions of stakeholders, their roles in advancing TOPS' mission, or titles for team members yet
d) Panelists would like for TOPS to have authentic partners and interact more with people at Minority Serving Institutions (MSIs)
e) Lack of lack of transparent workflows and processes to engage stakeholders and develop AGU's OpenCore material

Opportunities:

a) Deploy the OpenCore content as open access and on a Git-based repository in an easily reusable and remixable format (with appropriate license) for people to easily embed the curriculum onto various sharing platforms
b) Create a stakeholder map that shows involvement type based on location
c) Explore Memorandum Of Understandings (MOUs) with international partnerships with international scientific organizations (i.e. CNRS, UNESCO), and researchers in other countries to build a truly global identity that open science enables
d) Develop a TOPS guidebook that can be used internationally for other organizations to develop and implement an open science program
e) Use plain-language summaries to make open science more accessible
f) Define goals for each year of the TOPS mission, moonshot goals and major milestones

Threats:

a) Resistance to culture change
b) Lack of buy-in from organizing societies and conferences
c) Lack of transparency and clear definitions of roles seems to be hindering progress

Further unaddressed comments and recommendations from the panel:

- NASA currently defines 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. Panelists recommended the NASA TOPS team first define science and then explain what the agency aims to achieve with the adjective "open". Defining science as a "culture enabled by"

is likely to receive pushback from many people who have a different understanding of the word "science".
- The panel also urged the TOPS team to clarify if the goal is "building community" or "engage/visibility", which is implicit and not made clear inside the documents.
- The panelists pointed out that measuring changes in social enterprises like science is hard, unlike disciplines like Anthropology, Sociology, and Social Psychology that have developed methods for measuring changes in social systems. Therefore, the TOPS team should discuss how we measure participation in TOPS, including by the systematically marginalized and underrepresented communities.
- The NASA team discussed the role of the "community panel" and how the inaugural panel has mostly contributed as a consultative body rather than an overseer of governance. The panel expressed interest in being involved more strategically and included suggestions for continuing their service with more explicitly defined responsibilities.

4) Day 2: Curriculum Development Strategy

TOPS aims to meet everyone where they are at on their open science journey. While some members of our growing community may have practiced open science for many years, others may be trying to transition to a new way of conducting research or are students who are looking to begin their scientific careers likely unaware of open versus closed/restricted practices for sharing research output. As such, TOPS' first priority is to develop the infrastructure to train 20,000 scientists and researchers as part of our five-year program. This open science curriculum will introduce those beginning their open science journey to important definitions, tools, and resources; and provide participants at all levels recommendations on best practices from existing open science resources as well as subject matter experts connected via the TOPS network.

For the 2023 Year of Open Science, TOPS is developing strategic partnerships with large scientific associations to teach open science during large annual meetings, special science team summer schools, and other events. The vision for the TOPS OpenCore and other learning resources is for a CC-BY licensed, online and open course, hosted on the OpenEDx platform, that can be used to train scientists and award NASA open science badges.

The TOPS curriculum will also be used to support researchers looking to engage with NASA as NASA moves to adopt more open science requirements (e.g., Scientific Information Policy and ROSES opportunities). Scientists will need to acquire the new skills highlighted in the curriculum to participate in open science

effectively and to demonstrate those skills when applying for NASA funding opportunities.

Strengths:

a) Well designed call for participation, integration of honoraria to support and recompense for volunteer work in OpenCore and community panel
b) Thorough research-based content can be reused from various high quality and widely recognised open science projects to inform the development of OpenCore.
c) Have too much content that needs to be presented for short-format courses (this point is also a weakness).
d) Hired a diverse set of experts in the open science field from all over the world as the SMEs and module leads.
e) Commitment to make a high-quality, five module course on open science that can be adopted by NASA researchers

Weaknesses:

a) Lack of transparency in the process to engage the module lead in the material development and closed review and editing process deployed by AGU for the OpenCore modules.
b) SMEs do not feel ownership of their work as the materials were either discarded or edited massively without their involvement or knowledge. The authorship status is unresolved - major issue with attribution and authorship
c) Have too much content that needs to be presented for short-format courses.
d) Two sets of curriculum and no plan for consolidation, which may go against the open science ethos failing to model the behavior we want to promote
e) Behind schedule - material will not be ready before the start of the Year of Open Science
f) No teachers for in-person courses and no plan to train the trainers in place, although expertise exists and have been identified from other projects
g) No method of handling public reviews, although a strong willingness and intention have been demonstrated by the TOPS team

Opportunities:

a) Make a clear and transparent workflow of the creation and review process of the OpenCore modules.

b) Share clear roadmap, milestones and long term vision with opportunities for where different stakeholders will engage
c) Define roles and responsibilities clearly for all parties, ensuring accountability, shared ownership and equity in terms of their participation.
d) Facilitate reviews from researchers unfamiliar with open science from NASA and from the wider public, improving its potential to get adopted effectively

Threats:

a) Confusion about authorship and review/editing process is hindering progress on the modules and preventing the team from meeting deadlines.
b) Suggests an external facilitator is invited to mediate between NASA, AGU, SMEs and module leads by facilitating constructive discussions separately in safe environment
c) Need to step back and define governance, authorship, and other community roles, etc.
d) Depending too much on the OpenCore modules delivered by AGU will cause further delay, impacting the overall vision of TOPS negatively. There should be more ways to build capacity and skills in open science where "ready made" resources and capacity building efforts from the broader open science communities can be used – as mentioned in the previous panel.

Further unaddressed comments and recommendations from the panel:

- The TOPS team shared that they are developing strategic partnerships with large scientific associations to teach open science during large annual meetings. The panelists were interested in supporting and learning about associations such as CNRS, UNESCO and US organizations (other than AGU) that have partnered with TOPS. They also asked to clarify if the term large used for size or based on larger following/impact and how small/grassroots organizations will have the opportunities to engage.
- Day 2 at JPL led to suggestions that NASA specifies a syllabus and assessment methods to issue badges. NASA should enable a federated strategy so that universities and other partner organizations can build and deliver diverse training programs that produce badge-able cohorts. One such path could be through OpenCore as delivered on Open edX - but the emphasis on a single pathway via an Open edX MOOC is more closed than an approach that enables federation. NASA should therefore define the syllabus and assessment-leading-to-badge and enable many partners to develop diverse training programs using their own materials that are contextualized (respecting existing local resources and knowledge). All learners can then

take a test to assess their own understanding of open science and get a badge. This will accelerate the achievement of the 20k badge much faster. Although the faster badging might likely end up occurring largely for people outside NASA, it will generate an impact for TOPS to make a stronger case for internal training and adoption of practices.

- Panelists have also recommended deciding on NASA's recommended license type to be explicitly aligned with an open license (such as permissive licenses of Creative Commons, MIT, Mozilla etc).
- On the use of the term “hired” for “OpenCore SMEs and module leads“ - panelists asked for the use of an appropriate title/term for invited/convened participants or volunteers. The honoraria offered by TOPS/AGU were meant to recompense for their time and engagement rather than giving employment, except for those who might have worked as contractors. TOPS should be careful with how they record their roles.
- The Day 2 discussion also revealed power dynamics that need to be carefully addressed. NASA is powerful and has contractually engaged with AGU (which is also a powerful organization) to develop an open science curriculum and training pathway. The AGU <> NASA <> SMEs triangle is not power-balanced. There is a significant risk to the success of TOPS if the subject matter experts convened to define the catalyzing curriculum for the Year of Open Science leave their initial engagement with AGU + NASA feeling disrespected. While the SMEs have less institutional power than NASA and AGU, they have significant influence within the communities naturally aligned as TOPS allies. In open science, co-created materials are generally not treated as a transactional exchange of one-time labor for money, unless explicitly defined/agreed upon.
- Regarding the unclear authorship and review/editing process, panelists pointed out the threat of tokenizing diverse participants in TOPS if their contributions are not respected and valued. TOPS have always shown support for advancing the impact of the open science movement for culture change by respectfully involving global participants in their work. Panelists emphasized for TOPS to also model the behavior that open science worldwide is working hard to achieve/establish, to avoid the risk of undervaluing equity, diversity and fairness alongside "inclusion". Meaningful roles and incentives for members from marginalized communities should be established for setting good examples of what diversity can do for open science and vice versa.

5) CRediT Author statement

Please note the section (last name and what you worked on (original text, edits, figures, comments, organization…). Eg. Day 1: Perez, Sharan, Hightower, original text. Wu, Woodley, edits.

6) Appendix A: Panel Information

Day 1: TOPS Year of Open Science Strategy

Links to slides, video recording, transcription.

Day 2: TOPS Curriculum Plans

Links to slides, video recording, transcription

Summary:

PDF of all slides, all days.

Proposed Schedule for TOPS Community Panel Activities:

5-6 October: Community Panel Meeting #1
18 November: Assessment on TOPS strategies and curricula
~31 December: Release assessment findings on Github/Zenodo

7) Appendix B: Daily Recap

Day 1: TOPS Year of Open Science Strategy and Community Development

Time (PT)	*Agenda Item -10/5/22*	*Description*
	Day 1: TOPS Objectives and Year of Open Science Path Forward	
8:40am	Meet at JPL front entrance for badging and admittance	Cynthia Hall
9:00am	Review of Agenda and Code of Conduct	Chelle Gentemann
9:05am	Introductions to Panelists	Yvonne Ivey
9:10am	Icebreaker	Cynthia Hall
9:30am	Welcome	Kevin Murphy
9:45am	**Coffee Break**	
9:50am	TOPS Update	Yvonne Ivey
10:00am	Building TOPS: Spring Panel Feedback and Actions	Chelle Gentemann
10:45am	**Coffee Break**	

11:00am	2023 Year of Open Science Activities and Partnerships	Yvonne Ivey
11:30am	Discussion: Gaps in the Year of Open Science Plans	Isabella Martinez
12:00pm	**Lunch**	
1:00pm	Community Development	Cynthia Hall and Isabella Martinez
1:30pm	Discussion on Community Development	Isabella Martinez
2:00pm	**Dance Break**	
2:05pm	Tell us about what you are doing that we can work on together	Cynthia Hall
3:00pm	**Snack Break**	
3:15pm	Framed Discussion	Isabella Martinez
4:10pm	**Break**	
4:15pm	GitHub Activity	All
4:55pm	End of Day Wrap Up	Chelle Gentemann
5:00pm	**Day 1 of Panel Ends**	
6:00pm	**Group Dinner in Pasadena:** Cafe Santorini 64 W Union St, Pasadena, CA 91103	

Recap:

The first day of the workshop was filled with lively discussions, brainstorming, and panelists providing feedback on TOPS planned activities for 2023, the Year of Open Science. After a fun icebreaker activity, where participants became acquainted , Kevin Murphy, the NASA Chief Science Data Officer, presented on framing the motivation of NASA's participation in open science activities. Everything ties into NASA's Scientific Information Policy SPD-41a which states that scientific data should be FAIR, research software should be publicly available, and manuscripts should be published as open access by the end of 2025. In addition to TOPS, NASA is already participating in other open science projects that Kevin showcased: the SMD Science Discovery Engine and the NASA Astrophysics Data System. Next to present was Yvonne Ivey, the TOPS Equity Lead, who gave an overview on the ROSES solicitations related to open science and the goals to broaden participation by historically underrepresented communities.

Chelle then addressed how the TOPS team has tackled the panel's recommendations and actions since May 2022, which included: expanding the Year of Open Science beyond NASA, using GitHub to share resources, building an Open Science Cookbook, soliciting a ROSES proposal called TOPST, and more. All TOPS resources are freely available and CC-BY licensed. TOPS is using tools such as Zenodo to publish materials publicly and with DOIs.

The remaining morning session was dedicated to a structured discussion designed to solicit feedback from the panelists. TOPS asked the participants three questions: What are we **doing well** on our journey towards these goals? What are we **not doing** that we should do? What are we **missing** as we grow an open science community? A main topic of discussion was "how do we accurately measure success for open science?". One panelist suggested that the quantity that the material has been shared and reused and adapted for different purposes, could be used as a success metric. The idea of "plain language summaries" was brought up to make science more accessible to other scientists and people in general.

The Year of Open Science will kick off in January 2023 at the American Meteorological Society (AMS) meeting, and TOPS has plans to attend 12 large society meetings in 2023, organize hackathons, prioritize events at non-R1 Minority Serving Institutions (MSIs), and achieve moonshots. A 'moonshot' is defined as a high risk, high reward activity that solves big science challenges. Yvonne led a discussion on: What gaps exist in the Year of Open Science plan? And how can we address those gaps?

There was a lively discussion about future open science workshops, and several panelists suggested conducting pre-conference workshops or dinners during the conference, getting buy-in from the organizing committee of the conference to help promote the workshop, and making the workshop materials available online for all to watch to reach a wider audience. Partnerships with NSF, NIH, UNESCO could strengthen and broaden TOPS reach in the open science community.

After lunch, Cyndi Hall and Isabella Martinez gave an update on TOPS community development efforts which include blog posts about open science success stories and participating in the SpaceApps challenge. TOPS is developing an online engagement plan to reach as many people as possible to spread the word about TOPS. Isabella presented a list of topics of potential blog posts for the upcoming year.

The discussion turned to some people seeing GitHub as a technical barrier, fear of unpleasant interactions and harassment on the online platforms, responsibility to create a safe space for all, and creating opportunities to have balanced discussions. A key topic that came up several times was defining the stakeholders, and defining roles and responsibilities for everyone involved in TOPS. It was

recognized that giving people titles and making them “champions of open science” empowers people to go out and showcase open science in practice, as well as liaise with TOPS to spread the ethos of open science. Transparency and clarity are themes of open science that TOPS is trying to address.

The final topic of the day was building a sustainable community beyond the Year of Open Science and thinking about the next five years, ten years, etc. The TOPS team encouraged everyone to think about how TOPS is bigger than all of us. NASA has lofty goals but recognizes it is limited by time, funding, energy, etc.

Recommendations from Day 1:

- How do we measure success for open science? Consider measuring how much the material has been shared, reused, and adapted for different purposes – it could inform how we encourage people to do more open science
- An outcome of TOPS could be a resource with a menu of options - which provides examples and includes types of open science outcomes and intellectual criteria – so that it can be used internationally. Although in the spirit of ‘not reinventing the wheel’, this resource should not rewrite what many projects have already done, but curate existing resources appropriate for NASA TOPS stakeholders
- Make all open science outputs citable and reusable, e.g. give all materials DOIs and appropriate license allowing reuse
- Have trainings on plain language summaries - have experts or a ‘bureau’ to train people to translate peer review papers into “easy to understand” science
- In regards to the half day workshops, suggest a pre-event workshop on OpenCore and get buy-in from the organizing entity/society to make it an official part of the event
- Deploy the OpenCore curriculum as a Git-based repository with the raw source rather than rendered outputs, so societies can easily embed or adapt the curriculum within their websites
- Workshops at conferences are limiting — make course materials available online, make them open access — at GitHub or Jupyter Hub (producing videos helps)
- Reach out to international societies and organizations beyond AGU that are already embedded in open science movement
- Process transparency is missing - make things more transparent to all who are working on them

- Need to make a **stakeholder map** that shows who is engaged where and doing what to help identify gaps in stakeholder engagement
- Explore MOUs with international partnerships with CNRS, UNESCO, and researchers in Latin America, for example.
- Give the champions powerful titles, appropriate remuneration, and empower them to make some decisions that helps them lead of efforts that are well aligned with TOPS

Day 2: TOPS Curriculum Update

Time (PT)	***Agenda Item -10/6/22***	***Description***
	Day 2: The Open Science Curriculum	
8:40am	Meet at JPL front entrance for badging and admittance	Cynthia Hall
9:00am	Introduction and Review of Code of Conduct	Chelle Gentemann
9:10am	Honoraria Q&A	Annie Rattanaphone
9:20am	TOPS Open Science Curriculum Update	AGU
9:50am	Curriculum Discussion (Part 1)	AGU
~~9:45am~~ 10:15am	**Coffee Break**	
10:20am	Curriculum Discussion (Part 1.5)	AGU
~~10:20am~~ 10:30am	Curriculum Engagement and Retention Strategy	AGU
10:45am	Curriculum Discussion (Part 2)	AGU
11:30am	**Coffee Break**	AGU
11:35am	Curriculum Discussion (Part 2.5)	

11:45am	End of Day Wrap Up	Yvonne Ivey
12:00pm	**Lunch**	
1:15pm	JPL Tour	All
3:00pm	**End of Meeting**	

Recap:

The second day began with Brooks Hanson from AGU providing an update on the OpenCore curriculum. He acknowledged that there is a culture change needed for open science, and that the key to achieving this is excellent communication and working across disciplines in a way that has never been done before. Brooks mentioned "convergence science" – science research that is transdisciplinary, complex and focuses on societal needs. Next year, AGU will have a theme related to open science that will be announced at the 2022 AGU Fall Meeting.

The conversation turned to the OpenCore curriculum and the work that has been accomplished since May 2022. Brooks showed the initial plan for making the five modules, developed with/by open science experts in a fully open process during a sprint in early summer 2022. There was a tight schedule and lack of knowledge of full design constraints. Brooks gave the analogy of flying a plane while designing the plane and changing the design while flying the plane.

Brooks reviewed the OpenCore Minimum Viable Product (MVP), which included: a focus on Earth and Space science in stories and narrative, support NASA guidance (SMD41a), introduction to open science for open science-naive researchers. He emphasized the focus on U.S. laws and regulations versus global. The goal of OpenCore is five courses, two-and-half hours, online and in-person. The main course material comprises five modules: Ethos of Open Science, Open Tools and Resources, Open Software, Open Data, and Open Results. Each module should be two-and-a-half hours long, but Brooks said the content is approximately five hours after this initial development. Ethos will be ready by the Fall Meeting, maybe one other course. The goal is to have everything online by April 1, 2023.

There were some discussions about the right way to credit and attribute that content. A few SMEs and module leads, including Malvika from the panel who was involved as a SME expressed their concerns regarding how the steps taken in OpenCore module development ended up making SMEs excluded from the process related to the materials they were asked to collaboratively inform and develop – drawing from their expertise and existing resources from open science projects. The SMEs commended the strength of OpenCore's call for diverse contributors as

well as their generous honoraria, however there was no transparency around how the initial materials developed by them were handled. Most of the SMEs work on materials were either discarded or edited massively, and hence no longer being accurately represented in the final product of the OpenCore modules.

The SMEs acknowledged that the expectation was not to use what was written in one week, but to collaboratively edit and improve afterwards as generally practiced in open science projects. However, these members were not involved or made aware what approach was taken to edit the content after the initial five-day working period. They were not told several key things about the process or the initial expectations from the AGU. Not knowing what the final version of OpenCore would look like and if any of the initial contributions will be considered did not make SMEs and module leads feel comfortable putting their names on a product they did not have agency on. For example, the SMEs were not told the constraints of NASA or the U.S. laws and regulations about data. There were also some constraints with NASA's GitHub access levels – only two people are moderators and can merge pull requests, and those must be NASA employees/civil servants.

There are now two versions of the course materials – one is the foundational material the SMEs wrote, and the other is the OpenCore material that AGU received a grant for. Jim Colliander stepped in and acknowledged this was an awkward/uncomfortable conversation with different power dynamics in the room. Other panelists also mentioned that such situations have been previously experienced in different open science projects and the panelists can collectively offer suggestions on how to move forward and avoid such situations in the future. Monica and Jim suggested that NASA needs to set up a forum outside of the current meeting to understand the valid concerns raised by SMEs and the module leads. Monica also recommended bringing an external facilitator to moderate discussions if needed. The SMEs agreed to this, but emphasized they wanted clarity on the review process of the materials. Some SMEs on the call pointed out that they understood that there were no future expectations regarding their involvement, but they should have been told how they can track changes made to their contribution, in line with the standard open science process, in order to make the final product.

Chelle said that the timeline issues are mainly driven by the TOPST ROSES solicitation, whose deadline is on December 8, 2022. The aim was to have the full online course available by April 1st, so that is driving most of the decisions related to that. Brooks acknowledged all the work that's already been done for the foundational material, and emphasized that we all want very high-quality content. There was concern over the mid-career folks who needed to be heard. There now appear to be two versions of the curriculum: the foundational material developed

by AGU and the SMEs, and the NASA version. There was no consensus or path forward on how to consolidate these two.

The issue of training the trainers was brought up again by SherAaron and provided insights from The Carpentries' work in running 'train the trainer' programme successfully using community developed training materials. Chelle responded that NASA will be revisiting that issue. Malvika shared how the review process was handled at The Turing Way. It was more of a community handbook, so that people could replicate it. This handbook had clear contribution guidelines including the 'all-contributors bot' and record of contributions, a clear code of conduct, and community building efforts etc. It's important to not just teach what NASA thinks open science is, but that NASA is introducing people to a framework of openness. There were weeks of iteration of the review process for the community handbook at The Turing Way, and weeks of incorporating those changes.

There was general consensus to push the timeline back in order to accommodate changes and edits to the course materials. At this point, it was agreed to take a step back and fix some of the major issues before going forward. Fernando Perez shared an instance of international collaboration in which there was a partnership in the process of editing content. Everyone in that project was communicated with clearly, and brought along in the process, so everyone felt happy with the end products.

As the meeting wrapped up, Brooks gave some final comments that AGU is hoping to reach more than 20,000 signups in the next five years. He is optimistic that with the right training and awareness, we can all share the open science mission. Kevin Murphy gave his final comments, including that there are a lot of options for moving forward. We are learning this as we go, and thanked everyone for their participation and to keep the honest feedback coming. Chelle gave her closing remarks, which included being more intentional about our actions, creating an outline, working with facilitators, etc. She wants TOPS to help make science more equitable and create room so that more people have a seat at the table.

Recommendations from Day 2:

- Complete a set of reviews with the "novice" open science researchers (those new to or unfamiliar with open science) to review the OpenCore materials
- Make the review process completely transparent and open – this may include making a flowchart of the review process and sharing with everyone on the team – the entire process should be well-documented
- Improve the process for he open review/public review of the materials - since the system was overloaded and we didn't know how to handle all the public's review comments

- Clarify the attribution and authorship of materials issue
- Develop plan for conducting 'train the trainer': who will be teaching the in-person courses? And how much training will those teachers receive prior to teaching the courses?
- Consider if TOPS needs more budget to accurately compensate the SMEs if they need to do more work
- Need initial on-line content by April 1st – work backwards from that date to meet deliverables
- NASA and AGU need to hire a third-party facilitator to work with the SMEs to come up with a consensus on how to work collaboratively
- Need key deliverables for the Year of Open Science – what are the deliverables we need to meet in the future? And could we iterate on that to meet one of the deliverables?

9) Resources

Please list any resources that may be of use with a brief description and link.

Example/reference resources - all available under CC-BY 4.0 for reuse with attribution

- The Turing Way Community Handbook: https://the-turing-way.netlify.app/community-handbook/community-handbook.html
- Contributor acknowledgement guideline: https://the-turing-way.netlify.app/community-handbook/acknowledgement.html
- Contributors guideline: https://github.com/alan-turing-institute/the-turing-way/blob/main/CONTRIBUTING.md
- The Carpentries Handbook: https://docs.carpentries.org/
- The Carpentries instructor training materials: https://carpentries.github.io/instructor-training/
- Transparency: the emerging third dimension of Open Science and Open Data | LIBER Quarterly: The Journal of the Association of European Research Libraries. (2022, November 21). Retrieved from https://liberquarterly.eu/article/view/10759/11900
- OpenSciency Repo where all the OpenCore contributors have added the draft produced after the TOPS OpenCore Sprint: https://github.com/opensciency - connected to Zenodo for version release.

Unresolved comments from the Panelists while reviewing this report

(Summary from this note has been included for each day under the title "Unresolved/unaddressed comments and recommendation from the panel")

Day 1

- Comment on "Open science means different things to different communities. TOPS encourages a definition of open science that is Findable, Accessible, Interoperable, and Re-usable (FAIR). "
    - James C.: Yes, but this is NASA. NASA is leading here and should confidently define SCIENCE and what it means to open science up.
    - Malvika S.: I think it is fair to acknowledge that it means different things, but agreed that maybe NASA needs to define what open science means as per TOPS. Hence extending the sentence "Open science means different things to different communities. We define open science in NASA TOPS as ..., and our moonshot goal is ...
    - Cynthia H.: This is how NASA is defining it...You are suggesting we add that here? NASA defines 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.
    - James C.: I suggest that NASA first define science and then explain what the agency aims to achieve with the adjective "open". I suggest that defining science as a "culture enabled by" is going to receive push back from many people who have a different understanding of the word "science". I suggest that NASA consider science to be defined as "a systematic social enterprise that builds and organizes human understanding of the universe with testable explanations and predictions." and that "opening" up is an effort to improve the social enterprise.
    - James C.: I suggest that TOPS define science and then explain what the goals are for opening up science. I propose that Science should be defined as "A social enterprise that builds and organizes human understanding of the universe with testable explanations and predictions." The recognition that science is a social enterprise with the goal to improve understanding of the universe is an invitation to improve science by making it more open. The definition of science does not reference bibliometrics, personal gain, or other structures that some people point at when criticizing efforts toward openness.

Turn the tables and make opponents defend "closed" after they agree on the definition of SCIENCE.

- Comments under “Need to define how we measure success in open science”
    - Jim C.: We discussed ideas on this. Measuring changes in social enterprises like science is hard. Disciplines like Anthropology, Sociology, Social Psychology have developed methods for measuring changes in social systems.
    - Pen H.: Indeed. And this should include how we measure participation by systematically marginalized and underrepresented communities.
- Comment under “No clear definitions of stakeholders”:
    - James C.: Day 1 included a possible change in role of the "community panel". The inaugural panel has mostly contributed as a consultative body rather than an overseer of governance. Our discussion included suggestions that the community panel may evolve into more of a "board of directors" with more explicit responsibilities.

Day 2

- Comment under “For the 2023 Year of Open Science, TOPS is developing strategic partnerships with large scientific associations to teach open science during large annual meetings”
    - James C.: Awesome! Which associations other than AGU are partnered with TOPS?
    - Malvika S.: Also, is there a reason to work with only large organizations? What would a large organization mean? Would a small organization not have opportunities to engage?
    - Sher!: Is the term large used for size or based on larger following/impact?
- On the key areas and goals of TOPS:
    - James C.: The discussions on day 2 at JPL led to suggestions that NASA specify a syllabus and assessment methods to issue badges. NASA should enable a federated strategy so that universities and other partner organizations can build and deliver diverse training programs that produce badgeable cohorts. One such path could be through OpenCore as delivered on Open edX. I don't understand how to "share" capacity and suggest this key area be rephrased as "build capacity" to complement the first key area rephrased as "build community".
    - Malvika S.: I like this suggestion of federated approach, where NASA TOPS can put forward a syllabus that can be referenced even beyond

NASA, by different orgs in the US and outside to teach their researchers using own materials that are contextualized (respecting existing local resources and knowledge), who can then take a test to assess their own understanding of open science and get a badge. This will accelerate the achievement of the 20k badge much faster. Although it is likely that the faster badging might end up occurring largely for people outside NASA, it will generate an impact for TOPS to make a stronger case for internal training and adoption of practices.

- Common under "The vision for the TOPS OpenCore and other learning resources is for a CC-BY licensed,"
    - James C.: I suggest this vision be adjusted. NASA should define the syllabus and assessment-leading-to-badge and enable many partners to develop diverse training programs. The emphasis on a single-pathway via an Open edX MOOC is more closed than an approach that enables federation.
    - Malvika S.: Have we decided on the type? (4.0, SA, NC, etc.)
- Comment under "Hired a diverse set of experts in the open science field from all over the world as the SMEs and module leads."
    - Malvika S.: Were they hired or invited to participate as volunteers? My understanding is that the honoraria meant to recompense for their time and engagement- they were not given employment or contractor status. We should be careful with how we record their roles.
- Comment under "The authorship status is unresolved - major issue with attribution and authorship"
    - James C.: The Day 2 discussion also revealed power dynamics that need to be carefully addressed. NASA is powerful and has engaged with AGU (also powerful!) to develop an open science curriculum and training pathway. Through this partnership, AGU hired SMEs who are subject matter experts. The AGU <> NASA <> SMEs triangle is not power-balanced. There is significant risk to the success of TOPS if the subject matter experts hired to define the catalyzing curriculum for the Year of Open Science leave their initial engagement with AGU feeling disrespected. While the SMEs have less institutional power than NASA and AGU, they have significant influence within the communities naturally aligned as TOPS allies.
    - Pen H.: Strongly agree with this.
    - Malvika S.: Agree with this. Minor point, NASA or AGU did not hire the SMEs and Module lead (please link the call inviting applications from volunteers to develop materials, for which honoraria were offered).

This wasn't supposed to be an exchange of one time labor for money. Unless this was what they were told somewhere explicitly.

- Comment under “Confusion about authorship and review/editing process is hindering progress on the modules and preventing the team from meeting deadlines.“
    - Malvika S.: I think it is important to mention the threat of tokenizing diverse participants in TOPS if their contributions are not respected and valued. If TOPS can't model the behavior that open science worldwide is working hard to achieve/establish, a major risk will prevail where TOPS might end up teaching open science that doesn't value equity, diversity and fairness, but only "inclusion" without meaningful roles and incentives for members from marginalized communities. OpenCore process will end up setting a bad example for what diversity can do for open science and vice versa, which can have damaging impact on the open science movement overall where organizations and people with less power will keep pushing for culture change, whereas big and powerful organization will show example of TOPS to make argument against involving global participants in their work.