

generators (RTGs) when NASA contracts with commercial providers. Dr. Benardini said that specific NPR documents govern isotopic systems requirements. Asked who governs debris left by missions on the lunar surface, Dr. Benardini indicated that NASA has been engaged with NAS and COSPAR on this issue; the focus is on understanding organic compounds on the surface and is confined to requirements that have been put into place solely for organic contamination and propulsion fuel byproducts. Such things as terrain damage and “lunar litter” are outside the purview of NASA’s Office of Planetary Protection. Dr. Vinton Cerf pondered whether the Artemis Accords speak to some of these concerns and noted that the effort to introduce commercial activity to the Moon raises interesting questions about the conflict between science and private enterprise.

James Webb Space Telescope Update

Dr. Eric Smith, Program Scientist for JWST, provided an update, noting that the telescope represents a major international effort as well as the contributions of 29 US states and Washington, DC. JWST’s journey to the second Lagrange Point (L2) took place after a “textbook” launch on Christmas Day, 2021. The spacecraft was so precisely launched to a direct injection orbit that only a minimal amount of fuel was spent to correct the orbit, resulting in a net effect of doubling the mission lifetime. There was also a camera installed on the Ariane 5 rocket allowing clear imagery of the spacecraft separating from the rocket. All deployments have been completed successfully, comprising 29 spacecraft elements and 24 optical telescope elements. All 178 release mechanisms functioned as planned (139 associated with the sunshield). Currently NASA is commissioning the observatory, during which time all four science instruments will be checked out. Calibration will occur during Cycle 1 observations. Commissioning is a lengthy period of 180 days, driven largely by a cooling sequence designed to protect the optical elements. Only the mid-infrared instrument (MIRI) is cooled actively; the rest are cooled passively. All mirror segments are now below a temperature of 55 Kelvin, allowing movement into the instrument-commissioning phase. There are 730 high-level steps in the timeline, and still about 1000 total steps to go.

Onboard JWST, there are two near-infrared (NIR) instruments and one mid-infrared instrument: NIRCам, NIRSpec, and MIRI; and the Fine Guidance Sensor (FGS). The mission team checked for image sharpness last week using the Large Magellanic Cloud as a subject. There are 17 science modes for the instruments, with redundant capabilities. NIRCам is completely redundant (with two identical modules). Dr. Bakhtian asked if JWST data would be made immediately available to the public. Dr. Smith said the data releases would be hybrid in nature: observers will have the data for exclusive use for twelve months but many young researchers are electing to release their data at once. About 25 percent of the data will be available immediately.

At present, the mission team is running hot versus cold attitude tests to see how the mirrors respond thermally. Dr. Cerf asked if there was a difference between thermal noise effects on mirrors as opposed to sensors. Dr. Smith said that the telescope is more sensitive to things that are off axis such as starlight, hence it is more important to do things like keep the mirrors clean. Dr. Smith credited the Canadian team for its rapid, last-minute work on a tunable filter for its instrument, the FGS, and described the JWST Cycle 1 Long Range Plan. Cycle 1 is scheduled to begin on 27 June and will include the General Observation (GO), Guaranteed Time Observation (GTO), and Early Release Science (ERS) programs. The ERS teams will provide high-level tools and data products that will be useful for writing proposals for Cycle 2. Spectroscopy is already heavily subscribed. The types of science covered by the observation programs include the solar system, galaxies and the intergalactic medium (IGM), exoplanets, stellar physics, and more. Webb community events will be numerous, with 622 host sites registered, and these events will run from the end of June to October. There is also much information about JWST online, including the popular website Where is Webb, as well as presence on various social media platforms.

Dr. Bakhtian asked why data would not be made public immediately. Dr. Smith said that it was a matter of history and prior policy, for the most part. The JWST Memorandum of Understanding (MOU),

however, states that the director of the Space Telescope Science Institute (STScI) can advise NASA on changing the exclusive use period and NASA is expecting to receive a recommendation that the 12-month period be reduced. Dr. Mainzer noted that the effort of conceiving a mission proposal is time-consuming and that the proprietary period of exclusive use spoke to that effort. Dr. Woodward commented that calibration will be an ongoing effort during Cycle 1 so there is a natural iterative process in learning how to use the telescope, further undermining the need for a proprietary period. Asked about funding for Guest Observers (GOs), Dr. Smith said JWST has a \$60 million/year grant program, the largest in APD. Dr. Liemohn asked for some elaboration on the Canadian FGS. Dr. Smith said the instrument had been at risk of not meeting its delivery schedule and was simplified in order to be completed more quickly; the last-minute changes also added an exoplanet masking ability. It should be noted however that the secondary instrument was not part of the Level 1 requirement. Asked to estimate how long the mission would last, Dr. Smith said that JWST could function for more than 15 years. Additionally, the instruments won't have to be turned off after the fuel is spent, so that it could eventually be run like the "warm" phase of the Spitzer Telescope.

Potential findings and recommendations

Dr. Wadhwa noted that she had looked over old findings and recommendations during the last NASA Advisory Council (NAC) meeting and gave a quick synopsis for the benefit of the SC. Dr. Cerf suggested that findings include a formal acknowledgement of the spectacular success of JWST, adding that with the generation of new data, it would be beneficial to combine JWST data with other parts of the spectrum; it would also be useful to identify any metadata that could be combined with previously acquired data. Dr. Woodward noted that APD has an initiative to create an interactive archive that anticipates output from the Roman and Euclid missions. He noted that the HST is now being used most often for its archival data. Dr. Cerf said that Google has conducted much work with large-scale databases and offered to take this discussion to those of his colleagues involved in this effort. Dr. Bakhtian asked whether SMD has a formal way to address the impacts of cost and risk on innovation. Dr. Woodward felt this was a risk tolerance question and that Dr. Zurbuchen is thinking about the balance between NASA and the pace of commercial innovation while borrowing good ideas from both sectors.

The SC prepared to outbrief Dr. Zurbuchen. Dr. Cerf voiced concerns about the significant vulnerabilities engendered by the open source concept and put a link into the chat on the topic. Addressing the question on expanding the use of CLPS beyond the present, the Science Committee considered suborbital commercial flights, "plug n' play" LEO commercial activities, and the sustainability of companies in LEO. Mr. Weiser commented that NASA will need to know if these companies can be sustainable businesses. Are their business models working? He added that the community needs to be educated about CLPS so that it can help NASA think about expanding CLPS to other parts of NASA SMD.

Regarding feedback for IDEA efforts, SC members discussed the need to determine the definition of success in this area. Currently, they saw one focus on ROSES and one on data. Dr. Tucker raised the issue of having a pipeline for helping people move from one level to the next; ROSES has typically been the pipeline enabling PIs to move to larger missions. She thought there should be more of an effort aimed at keeping the pipeline full. She felt it would be beneficial to see a commitment to the pipeline and to helping grantees succeed. Mr. Weiser said the IDEA effort would need emphasis beyond activity to actual outcome. Dr. Woodward commented that a diverse workforce would be needed to execute NASA science. He felt a question for SMD would be how to measure the incremental progress and build metrics in order to identify and support successful programs. He stated that both the nation and NASA would benefit from a work force that is capable of critical thinking. Dr. Williams asked: If NASA's workforce does not look like the face of the nation, how can it inspire the US? How does making a data set available to a marginalized community help? She said there needs to be a symbiotic relationship between NASA and the workforce. Dr. Tucker suggested NASA could start by looking at the organization charts for the

big missions and to consider what message they send. Dr. Liemohn noted that positions matter and leadership matters.

May 4, 2022

Meeting Re-opening

Mr. Callahan called the meeting to order and made administrative remarks. Dr. Williams briefly reviewed the agenda and introduced the day's first briefing.

Climate Science Update

Dr. Katherine Calvin provided an update on climate research at NASA. Dr. Calvin recounted that she joined NASA in January 2022 as Chief Scientist and Senior Climate Advisor, and detailed NASA's place in climate science given the Agency's long history of Earth-observing missions. The Earth's temperature trend has been changing rapidly since temperature recordkeeping began in the late 1800s. The last 8 years have been the warmest on record, resulting in more precipitation, more drought, and more wildfire events. Research indicates that anthropogenic carbon emissions are largely responsible for these changes. Models predict that extreme events will increase as warming increases. Forest cover is decreasing, cities are growing, land use and land cover are changing. Changes in sea level are occurring; snow and ice cover is decreasing, the latter of which has implications for reflective versus absorptive radiation. The nature and balance of carbon sinks and sources is changing. Much of what is known about climate change has been derived from NASA data.

NASA is the agency that performs end-to-end research about the Earth and flies more than 24 Earth observing satellites, some of which have been observing the planet for five decades. NASA develops technologies that can help mitigate or adapt to climate change, such as NASA's aeronautics research and space operations on ISS. NASA also helps in disaster response planning. Dr. Calvin said NASA is working to make climate change data more accessible to researchers, planners, and vulnerable communities. She noted that NASA facilities are also affected by climate change.

This year, NASA will be launching several Earth Science missions. The Earth Surface Mineral Dust Source Investigation (EMIT) launches to ISS in June where it will observe mineral dust as it relates to air quality. The six-satellite Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of SmallSats (TROPICS) mission will launch to monitor the precipitation, temperature, and humidity of tropical cyclones. The Surface Water and Ocean Topography (SWOT) mission will launch in the Fall. It is the first global survey of water running in rivers and lakes and will help to complement data that traditionally comes from stream gauges. SWOT will also provide a better sense of ocean currents and circulation and ocean-mixing effects on temperature. The Aeronautics Research Mission Directorate (ARMD) will be testing the first all-electric airplane. NASA will continue to provide Earth observations and applied science products to those who need them, all while making NASA data more accessible.

Dr. Calvin said one of NASA's Climate Change goals is to lead with partners, such as working with LandSat via the US Geological Survey (USGS), in an effort to show the public compelling imagery and statistics to demonstrate what climate change looks like (for example, displaying the number of days above 90 degrees Fahrenheit). NASA is also committed to establishing an Earth System Observatory that will be completed by end of the decade, implementing interconnected core missions that provide information about aerosols, mass change, surface deformation and change, and surface biology and geology. The goal is to put all this data in one place. NASA will continue to partner in programs such as CSDA, buying data from commercial satellites when it makes sense, and openly communicating to the public.

Dr. Mainzer noted that identifying sources of greenhouse emissions is important to mitigating climate change and asked how NASA could help to facilitate and eliminate these emissions. Dr. Calvin said that NASA is developing technologies that will help to lower emissions and will be monitoring carbon dioxide and methane with the future Geostationary Carbon Observatory (GeoCarb) mission, as well as with air campaigns, helping to enhance climate modeling. Dr. Mainzer asked if it were possible to monitor gas plant leaks with NASA assets. Dr. Calvin said that the fiscal year 2023 President's Budget Request includes language directing NASA to develop a greenhouse monitoring office in tandem with other agencies including the Environmental Protection Agency (EPA). Dr. Godwin asked how NASA could help generate data that can help communities. Dr. Calvin noted that the website <https://climate.nasa.gov/> is a good start, emphasizing that it is a general goal at NASA to make it easier to access useful data. Dr. Williams asked for examples of data products that can inform vulnerable communities. Dr. Calvin cited OpenET (<https://openetdata.org/>), an online soil moisture tool for farmers. Dr. Woodward commented that visualization is important for non-scientists and asked how NASA leverages climate models and interpretive data for the public. Dr. Calvin said that visualizations are dependent on the audience. She mentioned that Goddard Space Flight Center has produced good visualization schemes showing how hot the Arctic has become. Another shows monthly temperature changes over time, as well as seasonal changes and how these have changed over time as well. There are similar maps for seasonal variations in carbon dioxide emissions tied to vegetation. She said it's an evolving, two-way conversation. Dr. Woodward asked how NASA communicates arguments about the accuracy of models. Dr. Calvin said that it is particularly challenging to communicate the uncertainties around modeling to a non-science audience. She said the visualizations about the future are useful in this regard. For example, wheat yields may rise while corn yields might decline in response to the increase in atmospheric carbon dioxide. She said NASA will need to think carefully about how to communicate this sort of information. Dr. Tucker asked about the National Atmospheric and Oceanic Administration (NOAA)'s relationship to climate change data. Dr. Calvin said that NASA has held three major events in partnership with NOAA since the year began. Regarding research, both agencies also collect information about surface temperatures and conduct independent verification, as well as producing a joint report on rising sea levels. EPA, DOE, and the National Science Foundation (NSF) all do climate research and there is coordination among these agencies.

Dr. Liemohn noted that the American Geophysical Union (AGU) has a Thriving Earth Exchange that connects scientists to communities for real-world problems and asked if NASA scientists participate in this activity. Dr. Calvin was unsure if NASA participates but noted that NASA does have several similar activities, such as SERVIR, a partnership with USAID, within the ESD Applied Sciences Program. Mr. Weiser asked how this activity is communicated outward. Dr. Calvin said that NASA keeps track of trainings and social media engagement and thought such monitoring can be expanded to get a better idea of the scope of the Agency's reach. Dr. Bakhtian commented that NASA facilities are impacted by climate change but are also contributing to it. As for making data more accessible, she said, NASA has an incredible soapbox. She asked if NASA could take on the role of educating the public on climate change. Dr. Calvin said that, on the issue of NASA facilities impacting the environment, a 2021 Executive Order directs that all federal agencies examine their emissions. Regarding education of the public on climate change issues, Dr. Calvin felt that NASA does well in making complex science easy to understand. The Agency has a strong outreach team that communicates climate science. She stated that there is also quite a bit of exciting science taking place beyond what was reflected in her briefing, which encompassed only activities in 2022. Dr. Calvin added that NASA needs to listen in addition to speaking, and to determine whether it is saying the right things, in the ongoing process of communication.

Division Advisory Committee (DAC) Reports

Astrophysics Advisory Committee (APAC)

Dr. Woodward, Chair of the APAC, provided an update. The committee held its most recent meeting at the end of March 2022. Its next meeting will be in June to address the Astrophysics Division's Senior Review. The March meeting agenda included discussion of the FY22 appropriation and budget wedges for mission development; appropriation language directed to NASA; funding for technology maturation; various missions and the impacts of COVID-19 and global supply chain issues; revision of the cost cap for the Roman telescope; GUSTO schedule slips; and the awarding of the Rossi Prize to the Neutron Star Interior Composition Explorer (NICER) team. The committee discussed some APD highlights, including the latest tally of exoplanets (5000 found, 4 percent of which were terrestrial in nature); and the successful launch of JWST, the International X-Ray Polarimetric Explorer (IXPE), CubeSats, and suborbital launch campaigns.

Dr. Woodward brought to the attention of the SC a set of specific APAC findings and recommendations on the James Webb naming controversy:

Findings:

Information contained within the Agency Freedom of Information Act (FOIA) document tranche suggests a new urgency for the NASA historian to assess carefully documents in the historical archives of the State Department and the Truman Library.

The APAC was dismayed to receive no formal record decisions and associated findings, despite the committee's specific request, that summarized the decision-making process that resulted in the Observatory's name remaining as is.

The APAC notes that NASA is committed to complete the additional investigation promptly, in the next few months, and to report publicly on the results.

- ***Recommendations:***

The APAC requests the APD strongly encourage the NASA historian's office to document fully and completely in a written report the current status of the ongoing investigation of archival materials, conversations, and other sources by the committee's 2022 July meeting.

The APAC advises that advancing the resolution of the Webb investigation may require additional future work and requests a schedule for timely and crisp completion of these activities.

The APAC requests the NASA historian be invited to provide a thorough debrief to the committee for the record at the committee's 2022 summer meeting.

The APAC advises APD to consider development of written policies and guidelines-of-practice of naming flagship missions that could build community trust and endorsement.

The APAC suggests that the findings of the NASA historian, the issue of James Webb memorialization, and the naming of future observatories be discussed by the NASA Advisory Council (NAC).

Other APAC findings and recommendations

Findings:

The APAC advises APD to continue close evaluation of the ROSES Inclusion Plans Initiative, as it extends to different programs.

The APAC requests Kevin Murphy, Transform to Open Science (TOPs) lead, to discuss with the committee at a future meeting the developments in this area, with a particular focus on the national needs and sensitivities to national security awareness of widely accessible and distributed scientific software codes.

Planetary Science Advisory Committee (PAC)

Dr. Mainzer, Chair of the PAC, presented an update of activities. The PAC had its last meeting in February; the next meeting will take place 21-23 June, principally to examine the Planetary Decadal Survey following its release. At the previous meeting the PAC received updates on PSD, the R&A Program, and Analysis Group (AG) reports. The PAC took note of the launch of the DART mission in November 2021. DART is scheduled to impact a double asteroid system in late September 2022 and will provide an exciting test of a critical technology for Planetary Defense. The Europa Clipper mission continues on its path to launch. Its imaging system has achieved first light and the spacecraft is on track to move into the Assembly, Test, Launch, and Operations (ATLO) phase toward a 2024 launch. The recent Decadal Survey made some key recommendations: the highest priority for the next decade is MSR, while recognizing the concern that the mission is ambitious and costly. The Survey contains language that supports MSR in the context of planetary program balance. The Survey also recommends that the next major Flagship be a Uranus orbiter and probe (with the caveat that the costs not overwhelm the portfolio) and that the Near-Earth Object (NEO) Surveyor be the highest priority for the Planetary Defense Coordination Office (PDCO). The Survey also includes a State of the Profession discussion and a discussion on keeping the community free from harassment. Lastly, the Survey contains recommendations for eight New Frontiers (NF)-class missions as well as NF and Discovery program cost caps.

PAC findings and recommendations (presented as information)

Finding 1: Several PAC AGs highlight that, while there is value in sharing software, the current draft of SPD-41 leaves a number of critical issues unclear. There are concerns that the policy could disadvantage new proposers and those without institutional resources to aid in compliance. The PAC commends NASA for putting the draft policy out for public review and encourages NASA to fully address the concerns raised by the AGs and by the community through the public comment process.

Finding 2: The PAC commends NASA for supporting inclusion, diversity, equity, and accessibility (IDEA) efforts in planetary science and working towards inclusive NASA-supported conferences and meetings. However, community-voiced concerns still remain regarding how to improve inclusivity and safety for under-represented minorities at NASA-supported conferences/meetings.

- ***Recommendation:*** To continue advancing IDEA principles in the community, the PAC recommends that NASA should leverage existing IDEA efforts, such as the IDEA Inter-AG working group, the NASA HQ IDEA group, or social scientists who focus on IDEA, to ensure that all NASA-supported conferences are as inclusive and safe as possible along multiple axes of representation, and particularly for historically excluded communities.

Finding 3: The PAC appreciates the initial efforts to identify avenues of community service within the planetary science community and estimated costs and issues associated with potential direct payment for such work. These efforts present an important starting point for a needed discussion and effort.

topography as well as a report from the ASAC on the matter. A DEIA review is on the agenda, focusing on how the NASA-wide initiative is being reflected in ESD. The last scheduled topic will be an Earth Science Communication Strategy.

Discussion

Dr. Bakhtian asked if ESAC had specific areas of focus on climate change. Dr. Tucker said yes, one ESAC focus is on carbon cycle and climate, and that there is strong representation of climate expertise on the Committee. She noted that Dr. Calvin, the Senior Climate Advisor, sits in the advisory space between the Applied Sciences Advisory Committee (ASAC) and ESAC, at the directorate level. While she reports to the Administrator, she is not a political appointee and is the first Climate Advisor for NASA. Dr. Woodward observed that there is increasing activity involving inexpensive satellites and CubeSats. He found it interesting that all the divisions are adopting these platforms to do exciting science that is also valuable to workforce development. He asked for Committee thoughts on face-to-face versus virtual meetings, given that APAC members feel that it will be very important to have a frank and public discussion on the JWST naming controversy. Dr. Bakhtian asked about data archiving and its implications for Open Data. Dr. Woodward said that there is an Agency-wide move to open data; in APD particularly, new missions will be returning massive, petabyte-level quantities of data, raising concerns about how to apply modern data science techniques. He said APAC is concerned that this is an under-scoped effort, and is also concerned about data fidelity, robustness, and distribution of data products. Archive modernization is an Agency-wide activity but it is hard for NASA to keep up with the rate of change in data science and in data handling techniques. He said NASA must also be cautious about open source code, as the policy has implications for national security. Dr. Woodward referenced the Big Data Task Force report (C. Holmes, *et al.*), and suggested a revisit of the topic. Dr. Tucker cited an ESAC concern for continued temporal and spatial coverage to support climate observations, noting that the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) mission turned out to be an unexpected climate mission. It will be important to ensure that NASA is working with other agencies for temporal and spatial continuity.

Dr. Mainzer reiterated that NASA has the capability of pinpointing sources of greenhouse gas emission and asked why it was not doing so, given that there are both nonprofit and for-profit companies taking this up challenge. Dr. Godwin asked if there were a way to identify the top 10 or 20 greenhouse gas emitters. The Committee agreed that this was possible, but that funding is a barrier. Dr. Mainzer felt that NASA should simply move ahead and do it. Dr. Woodward commented that ESD's SERVIR program has had great impact in improving agricultural planning in Africa, and that there is also CSDA data that could be helpful in this regard. The problem, he said, is how to use such data in cooperation with other agencies to pinpoint the location of greenhouse gas emissions. In this regard, he thought it might be useful for the SC to make some policy suggestions. Mr. Weiser said that NASA possesses rich data and extraordinary models, and thus might be able to find organizations with which to partner, and to help softly influence decisions that these organizations make. Dr. Williams commented that what NASA might like to do and what NASA is authorized to do can be quite different. Pinpointing methane sources, she said, would have to be addressed within NASA's science mission, and that cooperation with regulatory agencies such as EPA (as described by Dr. Calvin) provide an appropriate mechanism for translating NASA's research results. Dr. Tucker said that having the data publicly available is most important. Dr. Woodward noted that NASA can provide the observational continuity over time and should be encouraged to do this. Mr. Weiser suggested presenting the issue as one of education, in which NASA could disseminate the information directly to affected communities. He noted that JPL already does an excellent job of communicating what it does, and its simulation and visualization capabilities could work very well in this capacity as they did with the widely viewed and lauded Perseverance landing simulation.

Dr. Woodward commented that SMD has been able to accomplish an extraordinary amount of work over the last three years, maintained by a dedicated workforce. He felt this accomplishment should be recognized and applauded.

Findings and Recommendations Discussion

The Committee fielded input on the expansion of the CLPS model for procuring commercial services to other areas of SMD. Mr. Callahan took an action to write up the discussion. Mr. Callahan also took an action to determine the science makeup of currently planned CLPS instruments.

The Committee considered the question of ESSIO science and the question of balance within the new Planetary Science Decadal Survey, deferring further discussion to the next meeting.

The Committee discussed constraints on commercial activities at the Moon and issues such as “lunar litter.” Mr. Weiser noted that it was a complicated policy issue as well as a real science issue, given that these activities may imperil future science investigations. The Committee agreed that issues such as the contents of the Artemis Accords, documentation of affected areas on the lunar surface, planetary protection policies covering organic compounds and volatiles, the plans of the international community, and dust control on the lunar surface are also relevant and should be more thoroughly examined.

The Committee discussed how to account for the long-term viability of new space companies in NASA procurement of services, as well as returning mass from the Moon commercially for science/commercial purposes.

The Committee discussed further SMD IDEA updates on measuring various outreach efforts to MSIs and HBCUs, and how to reach non-traditional communities with training, Cloud access, and other tools.

The Committee discussed climate science. Dr. Tucker said that, regarding interagency collaboration, the SC would do well to confirm how the agencies are working together and to comment that it is critical to continue the collaborations. She appreciated Dr. Calvin’s answer on confirmation of observations from numerous Earth Science data sets and their application to different models. She recommended a finding on the subject. Mr. Callahan asked if NASA should lead reporting on the multiagency activity. Dr. Bakhtian noted that NASA has been taking a strong lead on educating the public on climate science and might be suited to take a larger role in the interagency collaboration, leading the effort to identify impact goals and how they are measured. Dr. Mainzer said that there is a data gap in measuring greenhouse gas emissions in terms of spatial and temporal continuity that NASA should work to address. She said NASA should also expand its efforts to monitor greenhouse gases. Dr. Bakhtian commented that there should be feedback loops to better understand how to have an impact with the data NASA collects regarding climate change. In addition, she said, NASA needs to ensure that researchers incorporate IDEA practices from the very beginning of projects and programs. Mr. Callahan asked if this comment implied that NASA should be training researchers in how to incorporate IDEA. Dr. Williams felt that the program calls themselves would have to codify the requirements for IDEA activity. Dr. Bakhtian suggested that the SC recommend that NASA train researchers to fully embrace equity and serve the underserved communities in its research efforts, where applicable. Dr. Godwin recommended that NASA have virtual meetings to educate communities on how to use NASA data, and to concentrate on local efforts. Otherwise, she said, it might be missing some grass-roots efforts by non-professionals. Drs. Bakhtian and Williams emphasized that IDEA is not just about giving out grants to the underserved but making sure that the grantee is supported to be able to succeed. Dr. Williams couched the recommendation in terms of creating strong metrics for the achievements and implementation of IDEA concepts. Mr. Callahan took an action to work further with Dr. Zurbuchen on clarifying how IDEA outcomes are measured.

The Committee discussed a finding praising the JWST team and the meritorious performance of SMD throughout the COVID-19 lockdown. Dr. Bakhtian suggested opening the data embargo on JWST. Dr. Mainzer noted there were large international partners on JWST and said she would be hesitant to support such a finding, adding that there are individual proposers who have their own data management plans, so immediate data accessibility is probably not an issue. She added that the PAC had raised concerns about NASA's SPD-41 policy and the legal implications of releasing software code.

Dr. Bakhtian commented on risk tolerance postures in CLPS, and how best to communicate to the public what risk or failure truly means in these commercial missions. Dr. Godwin felt that CLPS instruments were not on the critical path for Artemis. Mr. Weiser said that Artemis critical path ideas are enmeshed in VIPER because results could be critical to Mars in the future. He noted that as much as half of the science currently listed for the Artemis program is being conducted through CLPS missions, thus the SC could conceivably make recommendations on the science balance for CLPS. Dr. Liemohn said that HPD had held entire workshops for Artemis science and Gateway and imagined that there are many more ideas to be proposed. He said CLPS would be an interesting way to test a telescope on the far side of the Moon as just one example.

Outbrief to the SMD DAA

Dr. Williams briefed Ms. Sandra Connelly, Deputy Associate Administrator (DAA) for SMD, on the outcome of the SC meeting, presenting recommendations to expand planetary protection efforts at the Moon to consider future science impacts from lunar litter and a broader focus on human activity that may also undermine future science missions, as well as the obligations of commercial partners. She also detailed recommendations on data gaps in Climate Science; NASA training for researchers on how to implement IDEA where applicable; and disseminating NASA data tools to local communities through virtual training sessions.

Dr. Williams presented findings on providing training and infrastructure to help underserved grantees succeed and building timelines and other tools to measure trends, expected impacts, and hiring practices; the continuation of a robust interagency collaboration on coordinating climate data; potential NASA leadership on educating public on climate issues using behavioral science expertise; and applause for JWST and the excellent performance of SMD throughout the COVID-19 pandemic. Dr. Williams also commended the CLPS presentation for its content and clarity.

Ms. Connelly asked for some clarifications on the IDEA discussion and whether the SC had any thoughts about the future of work. Dr. Williams felt the workforce topic was worthy of continued discussion and Dr. Tucker said she had provided Dr. Zurbuchen some material on that subject. Mr. Weiser said that there is a general recognition that a mix of science and engineering—the latter of which needs to be conducted in person—is critical to NASA missions. He said that there are extraordinary tools, models, visualizations, and other methods required to get information to the public and that NASA needs to better understand how to engage with this information. As one avenue for feedback, he said, NASA could embed data in platforms that farmers use every day and could measure the data consumption rate in each application.

Ms. Connelly thanked the Committee for its service, findings, and recommendations. Mr. Callahan adjourned the meeting.

Appendix A Attendees

Science Committee Members

Dr. Ellen Williams, *Chair*, University of Maryland
Dr. Noël Bakhtian, Lawrence Berkeley National Laboratory
Dr. Vinton Cerf, Google, Inc.
Dr. Linda Godwin, University of Missouri
Dr. Michael Liemohn, University of Michigan
Dr. Amy Mainzer, Arizona State University
Dr. Sara Tucker, Ball Aerospace
Mr. Marc Weiser, RPM Ventures
Dr. Charles Woodward, University of Minnesota
Mr. Jason Callahan, Designated Federal Officer, NASA Headquarters

Other Attendees

Amy Reis
Joan Zimmermann

Appendix B

Science Committee Membership

Dr. Ellen Williams (Chair)
University of Maryland

Dr. Noël Bakhtian
Lawrence Berkeley National Laboratory

Dr. Vinton Cerf
Google, Inc.

Dr. Linda Godwin
University of Missouri

Dr. Michael Liemohn
University of Michigan

Dr. Amy Mainzer
Arizona State University

Dr. Willie May
Morgan State University

Dr. Sara Tucker
Ball Aerospace

Mr. Marc Weiser
RPM Ventures

Dr. Charles Woodward
University of Minnesota

Mr. Jason Callahan, Designated Federal Officer
NASA Headquarters

APPENDIX C PRESENTATIONS

1. Science Mission Directorate Update; *Thomas Zurbuchen*
2. Managing Delivery of Services: ESSIO; *Joel Kearns*
3. SMD Diversity, Equity, Inclusion and Accessibility Update; *Karen Flynn, Kate Becker, Michael New, Jade Singleton*
4. Planetary Protection Update; *Nick Benardini*
5. James Webb Space Telescope Status; *Eric Smith*
6. Climate Science Update; *Katherine Calvin*
7. Astrophysics Advisory Committee Report; *Charles Woodward*
8. Planetary Science Advisory Committee Report; *Amy Mainzer*
9. Heliophysics Advisory Committee Report; *Michael Liemohn*
10. Earth Science Advisory Committee Report; *Sara Tucker*

APPENDIX D
AGENDA

NAC Science Committee Meeting
NASA Headquarters
May 3-4, 2022

Agenda
(Eastern Time)

Tuesday, May 3, 2022

9:00 – 9:15	Opening Remarks / Introduction of Members	Mr. Jason Callahan Dr. Ellen Williams
9:15 – 9:20	Goals of the Meeting	Dr. Ellen Williams
9:20 – 10:20	NASA Science Update	Dr. Thomas Zurbuchen
10:20 – 10:35	Break	
10:35 – 11:25	Managing Commercial Delivery of Services – Exploration Science Strategy and Integration Office	Dr. Joel Kearns
11:25 – 11:35	Public Comments	
11:35 – 12:50	Lunch	
12:50 – 1:40	SMD Inclusion, Diversity, Equity and Accessibility Update	Dr. Karen Flynn Ms. Kate Becker Dr. Michael New Dr. Jade Singleton
1:40 – 2:25	Planetary Protection Update	Dr. Nicholas Benardini Dr. Elaine Seasley
2:25 – 2:40	Break	
2:40 – 3:30	James Webb Space Telescope Update	Dr. Eric Smith
3:30 – 4:00	Wrap-up Discussion	All

Tuesday, May 3, 2022 – Non-public Session

4:00 - 5:00 Discussion with SMD AA. Dr. Thomas Zurbuchen

Wednesday, May 4, 2022

8:00 – 8:10 Re-open Meeting Mr. Jason Callahan
Dr. Ellen Williams

8:10 – 9:00 Climate Science Update Dr. Katherine Calvin

9:00 –10:00 Division Advisory Committee (DAC) Chair Report
Astrophysics Advisory Committee Dr. Charles Woodward
Planetary Science Advisory Committee Dr. Amy Mainzer
Heliophysics Advisory Committee Dr. Michael Liemohn
Earth Science Advisory Committee Dr. Sara Tucker

10:00 – 10:15 Break

10:15 – 11:30 Discussion, Recommendations, and Findings All

11:30 – 12:00 Outbrief to SMD Deputy AA Dr. Ellen Williams
Ms. Sandra Connelly

12:00 Adjourn

Appendix E

Webex Chat Transcript

Tuesday, May 3, 2022

from Brad Bailey (Int) to everyone: 10:57 AM

We are also looking to protect certain areas (specific PSRs, heritage sites (e.g. Apollo 11), other int'l landed missions, etc). We are also trying to keep in mind the radio quiet far side and how to keep that environment capable of performing cosmological/radio astronomy research.

from Noel Bakhtian (Ext) to everyone: 10:58 AM

Thanks Brad

from Noel Bakhtian (Ext) to everyone: 10:58 AM

Are international partners included in these policies, in the hopes that all future countries doing this abide by same policies?

from Brad Bailey (Int) to everyone: 11:01 AM

Yes, but in pieces... some guidelines are laid out in COSPAR documentation, some are defined in the Artemis Accords, etc. But not all Moon-bound countries have agreed to a specific set of governing policies at this time.

from Noel Bakhtian (Ext) to everyone: 11:01 AM

Thanks!

from Noel Bakhtian (Ext) to everyone: 11:03 AM

There was a slide that mentioned that the hope is that NASA isn't the only customer of CLPS services - can international customers do missions through CLPS too?

from Noel Bakhtian (Ext) to everyone: 11:04 AM

Got answered verbally - thanks!

from b harvey Ext (Ext) to everyone: 11:27 AM

CPLS doesn't share with PDS?

from Brad Bailey (Int) to everyone: 11:32 AM

One small edit is that PDS isn't technically required for ALL science, but archival in a public repository that makes the most sense for a particular science instrument NLT 6 mos post-ops is required (PDS will host most of our science though)

from b harvey Ext (Ext) to everyone: 11:33 AM

why?

from Nino Cucchiara he/him, NASA HQ (Ext) to everyone: 1:05 PM

Q to Dr. New: can you say few words about how SMD plans to increase the obligated dollar to HBCU/MSI? Are we talking increasing MIRO/MUREP?

from Nino Cucchiara he/him, NASA HQ (Ext) to everyone: 1:42 PM

Q. to Dr. Singleton: can you comment on the inside-out approach. Specifically, how can SMD do step 1 without Step 5

from Nino Cucchiara he/him, NASA HQ (Ext) to everyone: 1:43 PM

In other words, [are] you trying to change inside without knowing what is needed from the community from the Diversity angle (you cannot know what you do not know)

from Noel Bakhtian (Ext) to everyone: 1:53 PM
what's COSPAR?

from Noel Bakhtian (Ext) to everyone: 1:53 PM
thanks

from Jason Callahan (Int) to everyone: 1:54 PM
The UN Committee on Space Research, where international planetary protection standards are discussed.

from Noel Bakhtian (Ext) to everyone: 1:55 PM
thanks!

from VINTON CERF (Int) to everyone: 2:45 PM
this makes me think of the streaming video show called Domino Masters....

from VINTON CERF (Int) to everyone: 2:55 PM
I have a question about the temperature of primary and secondary mirrors/instruments

from IRMA RODRIGUEZ (Int) to everyone: 2:55 PM
Is there a link to the video?

from VINTON CERF (Int) to everyone: 3:35 PM
Finding: The NASA Advisory Council Science Advisory Committee finds the successful launch and commissioning of the James Webb Telescope to be nothing short of spectacular. The committee anticipates extraordinary data to come from this new set of instruments. Combining this new data with archival data may pave the way for new insights into the history of our universe. We offer our enthusiastic congratulations on the JWST successes thus far.

from VINTON CERF (Int) to everyone: 3:36 PM
are we supposed to be seeing slides for these findings? I am only seeing the introductory slide

from Jason Callahan (Int) to everyone: 3:37 PM
Vint, no. Mini is just reading. I will send out the slides later.

from VINTON CERF (Int) to everyone: 3:38 PM
<https://openssf.org/>

from VINTON CERF (Int) to everyone: 3:45 PM
We'll know we have really arrived on the Moon when the first MacDonald's is opened there....

from Noel Bakhtian (Ext) to everyone: 3:45 PM
no organics there :)

from VINTON CERF (Int) to everyone: 3:45 PM

er, Moonshakes?

from Noel Bakhtian (Ext) to everyone: 4:47 PM

<https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/its-time-for-leaders-to-get-real-about-hybrid>

from Noel Bakhtian (Ext) to everyone: 4:48 PM

some general stats: <https://www.forbes.com/sites/forbesbusinessdevelopmentcouncil/2021/08/19/the-future-of-work-remote-hybrid-and-in-office/?sh=33ce2edc6168>

from Noel Bakhtian (Ext) to everyone: 4:49 PM

https://www.economist.com/special-report/2021-04-10?utm_source=google&utm_medium=cpc&utm_campaign=a_21futurework&utm_content=work&gclid=Cj0KCQjwpcOTBhCZARIsAEAYLuXtD5-FSk_aTY2QS7DJ_N_f2e3cvNzqjFiPIXEVM0_sFub5XGHPpAAaAhBXEALw_wcB&gclidsrc=aw.ds

Wednesday, May 4, 2022

from Lori Glaze (Int) to everyone: 9:19 AM

Thanks for your service, Amy.

from Amy Mainzer (Ext) to everyone: 9:20 AM

It's been a pleasure! Glad to have the opportunity.

from Noel Bakhtian (Ext) to everyone: 9:21 AM

impressive diversity on the agenda!

from Lori Glaze (Int) to everyone: 9:34 AM

Kate [Calvin] is at the Agency level

from Lori Glaze (Int) to everyone: 9:35 AM

she replaced Jim Green as Chief Scientist; + climate role

from Noel Bakhtian (Ext) to everyone: 11:14 AM

what's AO?

from Amy Mainzer (Ext) to everyone: 11:26 AM

AO=announcement of opportunity (the solicitation for a proposal, either for a mission or for a research grant)

from Noel Bakhtian (Ext) (privately): 11:29 AM

is this open to public?