National Aeronautics and Space Administration

NASA ADVISORY COUNCIL
Science Committee Meeting

Hybrid Meeting
October 8-10, 2024

Meeting Minutes

Nathan Boll, Executive Secretary

Amanda Hendrix, Chair

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Call to Order/Summary of Agenda
Dr. Nathan Boll, Executive Secretary of the National Advisory Council (NAC) Science Committee called the meeting to order and reviewed administrative details for the meeting. NASA Advisory Council (NAC) Science Committee (SC) is a federal advisory committee established under the Federal Advisory Committee Act (FACA) and the meeting was open to the public. He reviewed the FACA rules for the meeting.

Introduction of Members
Dr. Amanda Hendrix, Chair of the NAC Science Committee, welcomed everyone and began with introductions, followed by an overview of the agenda.

The committee members introduced themselves.

- **Amanda Hendrix**, Chair of the Committee.
- **Noël Bakhtian**, Technology Chair for NAC SC, Director for Tech Acceleration at Bezos Earth Fund; previously worked at NASA Ames, has a PhD in Aerospace Engineering.
- **Fran Bagenal,** Laboratory for Atmospheric and Space Physics at the University of Colorado, Boulder on the Juno team; work includes a focus on workforce issues and demographics of the pathway from STEM to career.
- **Paul Cassak**, Chair of Heliophysics Advisory Committee (HPAC), professor in the Department of Physics and Astronomy at West Virginia University
- **Van Espahbodi**, VC at Generational Partners, career in government in aerospace and defense contracting.
- **Jamie Foster**, Chair of Biological and Physical Sciences Advisory Committee (BPAC).
- **Linda Godwin**, professor emeritus at the University of Missouri, previously at NASA JSC for 30 years supporting the shuttle program, space station, and development of follow-on programs.
- **Edward Gonzalez**, Program Manager for Culture, People and Equity at NASA Goddard; previously Coordinator for Warren Christopher and the Christopher Commission and DEIA lead at Goddard Space Flight Center (Goddard).
- **Kelly Holley-Bockelmann**, professor of Astrophysics at Vanderbilt University and adjunct professor at Fisk University, with research focus on black holes and gravitational waves; Director of the Fisk-Vanderbilt Masters to PhD Bridge Program.
- **Hope Ishii**, Chair of Planetary Sciences Advisory Committee (PAC), research faculty in Hawai'i Institute of Geophysics and Planetology at University of Hawai'i at Manoa; affiliate with Molecular Boundary at Lawrence Berkeley National Laboratory, working on return samples and analogs**.**
- ***Tom Soderstrom*** *(unable to attend meeting), Amazon Web Services (AWS) Enterprise Strategist; former Chief Technology Officer and Chief Innovation Officer at NASA JPL.*
- **Sara Tucker**, Chair of Earth Science Advisory Committee (ESAC), BAE Systems Technical Fellow, career focus on active remote sensing with Doppler Wind Lidar Systems, and atmospheric science, weather, and air quality applications.

Dr. Hendrix mentioned and thanked a few individuals for their service to the committee, including Mr. Boll for his support. She acknowledged Ellen Williams, the most recent Chair of the SC, for her contributions through April 20 2024; Dr. Noël Bakhtian, Vice Chair, for her service as interim chair of the NAC SC, April – October 2024, and Dr. Sara Tucker, outgoing SC member, for her service. She then welcomed new members: Dr. Fran Bagenal, Mr. Van Espahbodi, Mr. Edward Gonzales, and Mr. Tom Soderstrom.

NAC Meeting Reports

At the May 2024 NAC meeting, Dr. Bakhtian, Vice Chair of the NAC SC, briefed the NAC on SC activity, including findings and recommendations (F&Rs) from previous meetings. At the October meeting, her brief was geared toward ensuring that those existing F&Rs were represented and categorized. She noted that final review notes on the F&Rs presented have not been returned by the NAC yet.

NAC decided to direct different F&Rs for different purposes: Some will go to the NASA Administrator, and some will be dispositioned from the Administrator to the Science Mission Directorate (SMD). Because there were so many findings, they were bucketed together to be sent to the NASA Administrator. With so many meetings and their F&Rs not reaching Dr. Nicky Fox in a timely manner, there was an action to the NAC Executive Director to ensure that those meetings happen on a more frequent basis (i.e., about 3 per year).

NAC meetings are about both delivering information and having general discussions. NAC has particular focus areas and comes up with their own F&Rs. From the NAC meeting on May 8-9, 2024, three topics surfaced as particularly salient to the SC.

1. Climate Change: A briefing is a part of this meeting; SC will continue to discover what, if anything, can go into F&Rs.
2. Planetary Protection: SC is trying to understand existing and future protections; e.g., there is recognition of the gaps in the protection for science of the Moon (beyond the standard definition of planetary protection) and a need to keep an eye on that.
3. Science and Space Diplomacy and the ISS Transition: This includes international travel by the Administrator, discussions with Brazil, the Artemis Accord, and the implications to space diplomacy that might occur with the ISS transition.

At the October 1-2 briefing of the NAC, SC reviewed membership updates and highlighted mission updates: NISAR, Earth Sciences Division (ESD); SEAQUE Biological and Physical Sciences Division (BPS); SPHEREx, Astrophysics Division (APD), EscaPADE, Heliophysics Division (HPD), and Europa Clipper, Planetary Sciences Division (PSD). There was a discussion with Senator Nelson and Colonel Melroy, including the NASEM Crossroads report, and NAC priority focus areas, including commercial industrial partnerships There was also information presented about NASA's Summer of AI, and all the NAC Committees presented.

A new NAC finding was proposed at the October 2024 meeting: The cancellation of the VIPER mission presents profound impacts on the understanding of lunar volatiles, a key foundation of the Artemis program, and it adversely affects the leadership of the United States in lunar exploration.

NASA Science Mission Directorate Update

Dr. Fox, Associate Administrator of the NASA Science Mission Directorate (SMD), welcomed the new members, thanked Dr. Bakhtian for her work, and congratulated Dr. Hendrix on the Chair position. She reviewed the layout of the SMD and mentioned leadership changes. She thanked Ms. Sandra Connelly, who will be retiring at the end of 2024, for her work in SMD and 30+ years of service to NASA; SMD is currently competing the position for a 1-year detail and then there will be an external search for permanent replacement. In May, Dr. Lori

Glaze was selected for a 6-month detail as Deputy Associate Administrator (AA) at Exploration Systems Development Mission Directorate (ESDMD). Dr. Gina DiBraccio is acting as the Planetary Science Director for 6 months. Dr. Wanda Peters, Deputy Associate Administrator for Programs (DAAP) was selected to temporarily serve as Deputy Center Director at Glenn Research Center, and Ms. Peg Luce has been acting as DAAP in her place. Ms. Amy Kaminski, from the Space Technology Mission Directorate (STMD), joined SMD as new Chief of the Engagement Branch. Dr. Fox said SMD strongly supports these details as they expand individuals' knowledge of the Agency and allow for diverse perspectives and opportunities for growth.

SMD is in the final stages of revising the SMD Diversity, Equity, Inclusion, and Accessibility strategy (DEIA; or "IDEA," within SMD) which will guide SMD for the next 2 years. The process includes listening sessions across SMD and finalizing actionable strategies. Particularly important to Dr. Fox is an inclusive environment that features leading by example. Inclusion is a NASA core value and remains a top priority for the Agency and for Dr. Fox, who hopes to publicly release the new strategy in the coming months. As part of fostering inclusion and following the 2023 organizational culture climate survey results, SMD has established priority actions, including the establishment of SMD-wide operating norms. Regarding workforce development, SMD is piloting NASA Leadership for Excellence, Advancement, and Diversity (LEADS), which provides professional development to support civil servant scientists who want to develop into leadership roles, and supporting staff in applying to prestigious development opportunities including the Leadership for a Democratic Society (LDS) program at the Federal Executive Institute (FEI). Workforce development is a focus of Dr. Fox; we want to prepare individuals to lead NASA science in the future.

Division Updates

Astrophysics

James Webb Space Telescope (JSWT): In July, SMD celebrated the second science anniversary of the JWST. Dr. Fox presented and discussed images from JWST and said it has transformed our view of the universe. The instrument commissioning team included 232 partners and the team recently received a NASA Silver Group Achievement Award for Execution in Commissioning.

Spectro-Photometer for the History of the Universe, Epoch of Reionization and Ices Explorer (SPHEREx): The mission that will provide the first all-sky spectral survey is a 2-year planned mission to collect data on 450M+ galaxies along with more than 100M stars in the Milky Way. Environmental testing is completed and the *SPHEREx* launch is planned for April 2025, with the Polarimeter to Unify the Corona and Heliosphere (PUNCH) mission as a rideshare payload.

Nancy Grace Roman Telescope: Thermal vacuum testing of the optical telescope assembly was conducted in September 2024. The spacecraft bus that will deliver Roman to orbit is complete after years of work.

Habitable Worlds Observatory (HWO): Is in the concept phase. Three industry partners have been awarded projects to help develop technologies. In August, an HWO Technology Maturation Project Office was established at Goddard.

Probe Explorers Selections: Two proposals have been selected for 12-month mission concept studies: the Advanced X-ray Imaging Satellite (AXIS) and the Probe for Infrared Mission, with a planned downselect to one funded Probe mission expected at the conclusion of these studies. These Probe missions will fill a niche between flagship missions and mid-sized Explorer missions.

Biological and Physical Sciences

Cold Atom Lab (CAL): The first-of-its-kind facility on ISS allows for the use of ultracold quantum sensors in space. For the first time ultracold atoms were used to detect changes in the surrounding environment in space.

Experiment Flown on Commercial Suborbital Rocket: A NASA-funded researcher flew on the Origins New Shepard Suborbital Rocket System and conducted their experiment about how changes in gravity during space flight affect plant biology. This is the first time that a NASA-funded researcher has flown on a crewed suborbital mission, opening new opportunities for targeted research.

Looking ahead, Dr. Fox discussed tissue chip experiments on Artemis 2, flammability studies, plant research on the lunar surface, the development of roadmaps related to the recent Decadal Survey, the Lower Earth Orbit (LEO) Microgravity Strategy, and ongoing development of partnerships.

Earth Science

Plankton, Aerosol, Cloud, ocean Ecosystem (PACE): This mission launched in February 2024 and allows scientists to detect and identify phytoplankton and look at different species that are the center of the ocean's food chain. PACE identifies a range of colors, to enable deeper study of the ocean, and it also looks at aerosols and clouds, allowing study of the health of oceans and the air we breathe. PACE also helps identify harmful algal blooms that can adversely affect fisheries and coastal communities.

Disaster Response Coordination System: This system provides support to organizations around the world and is a core element of the Disasters Program inside the NASA's Earth Science Division (ESD). It brings together resources across all NASA Centers to provide trusted timely and actionable science to aid decision makers during active disasters and to advance science for disaster resilience and planning. (At the time of this meeting, the team was activated across the Southeastern United States on the aftermath of Hurricane Helene, working alongside the American Red Cross, the United States Geological Survey [USGS], and the National Oceanic and Atmospheric Administration [NOAA]).

Environmental Justice Screening and Mapping Tool (EJScreen): NASA data were incorporated in the Environmental Protection Agency's (EPA's) EJScreen, now including nitrogen dioxide, a very harmful air pollutant. This update marks a crucial step in addressing air quality disparities in overburdened communities across the United States. The collaboration with EPA underscores NASA's commitment to using space-based observation to benefit public health and environmental justice.

Polar Radiant Energy in the Far-InfraRed Experiment (PREFIRE): This is Earth Science's newest mission focused on our changing planet. It started collecting data on the amount of heat in the form of far-infrared radiation being emitted into space. PREFIRE measurements are key to better predictions about how environmental change will affect Earth's ice, seas, and weather, and it gives a better understanding of when and where the Arctic and Antarctic emit far-infrared radiation.

NASA Indian Space Resource Organization (ISRO) Synthetic Aperture Radar (NISAR): Work on the radio antenna reflector for NISAR is nearing completion. Testing has been completed and NASA hopes to ship NISAR back to India in the near future. The reflector is designed to transmit and receive microwave signals to and from Earth's surface, allowing for scans of nearly all of the planet's land and ice surfaces to collect critical science data.

Dr. Fox invited those in Washington, DC, to visit the opening of the Earth Information Center (EIC) at the Smithsonian Natural History Museum that is scheduled to open on October 9, 2024.

Heliophysics

Dr. Fox mentioned the April 2024 total eclipse, which was visible in 15 states from Texas to Maine, and people throughout the contiguous United States were able to experience some part of this eclipse. A key part of the "Heliophysics Big Year"; in all, NASA distributed 2M+ sets of protective glasses, hosted 400 events, and there were 224 NASA engagement and science activations events.

Heliophysics Big Year: This year-long event was about raising the awareness of our favorite star and its impact on life and society. The Sun gave a lot of activity, X-class flares, and beautiful aurora. May was a particularly stormy month for the Sun: a huge barrage of solar flares and corona mass ejections, the strongest solar storm to reach Earth in two decades, and the strongest displays of auroras in the past 500 years. Thousands of reports were submitted to Aurorasaurus, a NASA-funded citizen science site. This was a great opportunity to raise awareness about the importance of solar and space physics and space weather.

Escape and Plasma Accelerator and Dynamics Explorers (EscaPADE): There are two identical spacecraft going to investigate how the solar wind interacts with the Martian magnetic environment. It is the first multi-spacecraft orbital science mission to go to Mars to reveal how the planet responds in real time to space weather and how the atmosphere changes over time. The launch schedule was delayed; launch may be in Spring 2025.

Parker Solar Probe (PSP): PSP will make its closest approach to the Sun on December 24, 2024, passing just 3.83 million miles above the sun's surface at 430,000 mph. A recent results paper, regarding the powering of solar wind streams by magnetic switchbacks, was published in the Journal of Science in Summer 2024. PSP aligned with the European Space Agency's (ESA's) Solar Orbiter, which allowed for multi-point measurements and is a good example of international partnership.

Looking ahead, Dr. Fox mentioned the launches of the Interstellar Mapping and Acceleration Probe (IMAP), the Electrojet Zeeman Imaging Explorer (EZIE), the Polarimeter to Unify the Corona and Heliosphere (PUNCH), the Tandem Reconnection and Cusp Electrodynamics Reconnaissance Satellites (TRACERS), the Carruthers Geocorona Observatory, and EscaPADE.

Planetary Science

Europa Clipper: Launch is imminent, spacecraft is encapsulated and ready to go on the rocket at NASA Launch Complex 39A [Europa Clipper successfully launched on October 14, 2024].

Near Earth Object Surveyor (Neo) Surveyor: This is the next-generation asteroid hunter, looking for other celestial bodies. Target launch is late 2027.

International Partnerships: The EAS-led Hera mission launched and is on its way to view the asteroid Didymos. OSIRIS-REx samples were returned and shared with JAXA in Summer 2024. NASA and ESA have signed an MOU for partnership on the ESA Rosalind Franklin Mission. Dragonfly confirmed a baseline launch date of 2028.

Lunar Science

Dr. Fox gave updates on three lunar instruments. The Lunar Environment Monitoring Station (LEMS) is a compact autonomous seismometer suite designed to monitor moonquakes; Lunar Effects on Agricultural (LEAF) will investigate how the Lunar environment affects the germination and growth of plants that may be used to feed astronauts of the future; the Lunar Dielectric Analyzer (LDA) can measure the ability of the regolith to propagate an electric field, a key parameter in the search for lunar volatiles.

CLPS: Under the Commercial Lunar Payload Services (CLPS) Program, NASA awarded a new set of science experiments and technology demonstrations that will arrive at the lunar South Pole in 2027. Intuitive Machines will deliver six NASA payloads to the permanently shadowed regions that could help reveal the origin of water throughout our Solar System and continue to answer key questions about volatiles.

VIPER: Although it will not launch the Volatiles Investigating Polar Exploration Rover (VIPER) this year, SMD is looking for innovative ways to accomplish the VIPER exploration and science goals. The instruments from VIPER can be rehabilitated and put on future CLPS missions or future rovers to the Moon. In late Summer 2024, a Request for Information (RFI) was sent out to US industry and international partners on the potential use of the mission to take advantage of engineering and technology development for VIPER.

Perseverance: The Perseverance rover recently discovered a fascinating, arrowhead-shaped rock that has some indications that it may have hosted microbial life billions of years ago. The rock has traits that may have bearing on the question of whether Mars was home to microscopic life. A sample of the rock needs to be brought to Earth for more detailed study. Dr. Fox said that studies are underway with the objective of lowering Mars Sample Return (MSR) annual and lifecycle costs, decreasing risk and complexity, and returning samples in a shorter timeframe, and said Perseverance is healthy and stable and has filled 28 sample tubes.

Overall, SMD is continuing to grow and evolve in a rapidly evolving Earth and space science ecosystem. It is well positioned to take advantage of emerging opportunities to get more science into space and to get more critical data. There is a very constrained resource environment, but priorities remain the same: exploration and scientific discovery, innovation, interconnectivity, partnerships, and inspiration.

Discussion

Dr. Hendrix thanked Dr. Fox for the terrific presentation. Dr. Bakhtian confirmed that she will continue to serve as Vice-Chair for the committee, said that she was excited to see a mission named after Nancy Roman, the first Chief Astronomer at NASA headquarters and the first woman to have an executive-level position at NASA, and she gave kudos to the disaster coordination work in SMD and at NASA.

Dr. Holley-Bockelmann noted that, with the budget cuts to Chandra and Hubble, there were significant threats of large layoffs (30% of the Chandra staff). She wondered about the view from the larger SMD level and the priorities for missions? Dr. Fox said that the priority is to maintain a balanced portfolio, including between legacy and new missions, to have each of the science divisions healthy and doing exciting things. And SMD wants to embrace the full size and scale of missions, from CubeSats to JWST and everything in between. She said there are tough decisions under a constrained budget in Astrophysics. They challenged older missions to see if they could operate for less and will continue to work with them. She noted that NASA Science was down by $1B against the President's Budget for FY24. It is an effort to keep the science from the legacy missions going and make room for new missions and ensure a bright future for early career and next-generation scientists and show that all the missions in the portfolio can be managed. Dr. Fox said her budget is embargoed but they have worked hard to minimize staffing impacts from budget constraints.

Dr. Paul Cassak asked about the prioritization of the "I," namely inclusion, in IDEA and wondered why it is prioritized. Dr. Fox said SMD does not only care about inclusion but without it there is not true diversity (analogous to the difficulty to have equity if you do not have accessibility); people need to be able to bring their whole selves to work, to feel

valued and a part of the team. She underscored that you have to have all four elements of IDEA to have a truly diverse workforce.

Dr. Cassak also asked how Dr. Fox thinks the National Academies "NASA at a Crossroads" report impacts SMD, missions, and R&A and R&D in SMD. Dr. Fox said the report is for the whole Agency and SMD focuses on making sure that there is support for the whole community, so it puts a focus on the R&A funds and research grants. She noted that the number one reason people come to NASA is to work on cool technology and exciting missions.

Dr. Cassak asked whether updates on the Geospace Dynamics Constellation (GDC) and the report required by Congress could be shared. Dr. Fox said the report was submitted but there has not been a response, yet. SMD is continuing to move ahead with the funding they have to move the maturation of the instruments and complete the design and get the instruments to a ready status. The President's Budget Request for 2025 does not include GDC, which is an indicator of the priority, but there is an effort to move the mission forward with the funding available. She said current drag models are in need of a mission like GDC, so it remains a priority. She also said that awaiting the HP Decadal makes it hard to push ahead on some things. Dr. Cassak mentioned that this would be his last committee meeting and Dr. Fox thanked him for his service.

Dr. Ishii asked whether the national posture advantages of being first to return samples from Mars might elevate the importance of getting MSR done, specifically prioritization of MSR at the Agency level in the currently limited fiscal environment. Dr. Fox, yes, it would be great to be the first to come back to Earth; she said there is excitement about better and better samples, and that Perseverance has made the in situ measurements that it can make.

Dr Hendrix asked, regarding all the exciting BPS-related science happening on the ISS and considering the move to more of a commercial economy in LEO and ISS, what does Dr. Fox see as the opportunities for doing science on these stations. Dr. Fox said there is huge potential to do the science. One thing to consider is rapid science; for instance, the Commercially Enabled Rapid Space Science initiative (CERISS) program, which would be iterative with scientists and astronauts out there doing the science and sending the results back without long waits for implementation and data, is enabled by these new commercial ventures. Dr. Fox is looking forward to working with commercial partners to figure out how to enable quick turnaround of the science. SMD is very involved with Dr. Lisa Simonsen and her team and interacting with people that are building the commercial space stations to ready plans. The LEO Microgravity Strategy that came out a couple of months ago lays out all the objectives. Finally, an international meeting with national partners will help determine whether and where organizations can work together.

Panel Discussion: NASA IDEA Initiatives and SMD Updates

Ms. Elaine Ho, AA for the NASA Office of Diversity and Equal Opportunity, gave a broad overview of DEIA, which has been both celebrated and polarizing, as critical to mission, teams, and partners. She said one- or first-of-a-kind missions require diversity of thought, background, and perspective that sparks innovation and creativity. DEIA is also inherent in the culture of safety at NASA. The work at NASA requires an emphasis on people and a focus on teamwork, and for successful partnerships, a diverse workforce is necessary to ensure NASA can effectively work with international partners for the benefit of all humanity.

There is a strategic plan for DEIA at NASA with four areas: workforce diversity, workforce equity and inclusion, accessibility and accommodation, and DEIA integration into the NASA

mission. She reviewed the four strategic goals focus on recruitment and retention, cultivation of a work environment that encourages collaboration, the inclusion of people with disabilities and of all religions in the intentional design and development of facilities programs and services, and the implementation of structures and strategies to measure and foster accountability to institutionalize a culture of inclusion. Ms. Ho spoke about how these goals related to science. She reviewed the "Draw-a-Scientist" test (1966-1977), which demonstrated strong stereotypes and biases, and the updated test (1985-2016), which still demonstrated some stereotyping and an imbalance based on gender.

Dr. Michael New, Deputy AA for Research at NASA SMD discussed DEIA Initiatives, spoke of the SMD response to the NASEM reports that were requested in 2022. The two studies made 33 recommendations, some of which were partially implemented at the time of publication or since the release of the reports.

Recommendations that have been implemented have resulted in the following: 1) It is now standard for Announcement of Opportunity (AO) proposals to require an "Inclusion Plan"; 2) SMD published research on the diversity of Astrophysics Explorer proposals and will continue analysis on AO proposals in 2025 (Dr. New commented on the importance of focusing on supporting women as Principal Investigators [PIs]); 3) The Mentoring and Opportunities in STEM with Academic Institutions for Community Success (MOSAICS) and Research Initiation Awards (RIA) programs explicitly target non-R1 institutions, which are less research-intensive than R1 institutions; these two programs target non-R1 institutions for collaboration and funding. For the MOSAICS seed funding, support includes a symposium in December, mentor training, office hours, and more to educate people during the process.

Additional results of recommendations that have been implemented include the following: the collection of metrics of participation in SMD research programs and making data available through SMD R&A Program Yearbooks; the development of IDEA Strategic Plans; and the assignment of responsibility for oversight of data collection and analysis to determine SMD success in creating a vibrant and healthy science community, include meeting DEIA goals.

Recommendations that SMD cannot implement on its own include the creation of a committee of the NAC dedicated to DEIA, although the Science Committee could make that recommendation to the NAC. Also, the NSPIRES Personal Profile questions and options cannot be changed by SMD, in particular the gender and race questions, which are limited by the categories used by OMB.

Discussion

Dr. Hendrix noted that there is now a DEIA committee on the NAC chaired by Ms. Jacklyn Wynn. Dr. Jamie Foster asked whether OMB gave rationale for the decline to change these items. Dr. New said that OMB indicated it was awaiting the results of an inter-governmental panel about this topic and would not approve any change to gender identity questions before those results were in. Dr. Foster, mentioning NSF, then asked whether SMD has thought about requiring each person in a grant proposal to expand the reach of teaching and research activities within the grant. Dr. New said NASA is in the second or third year of piloting the use of so-called "inclusion plans," which are about the plan to manage the team in an inclusive fashion. Although NASA doesn't do this work in the way NSF does, because the mandates are different, he noted that NASA has an Office of STEM Education that is very involved in training the next generation; and SMD has the Science Activation Program.

Dr. Ishii wondered how much MOSAICS is limited by the bandwidth of NASA researchers to support these types of collaborations. She asked whether the RIA and MOSAICS programs

require NASA partners. Dr. New said RIA does not and that MOSAICS was explicitly created to create, sustain, and expand relationships between NASA researchers and non-R1 faculty and students. Part of the intent was to generate NASA-savvy researchers and part was to provide NASA with a first look at potential hires. As yet, he has not seen fatigue.

Mr. Gonzales, who was the co-chair of the SMD Bridge Program, was troubled when the diversity wing at the University of Texas, Arlington was closed, with many layoffs, and he has noticed that happening at other universities and institutions. He asked for Dr. Ho's thoughts on the new administration and the state of using the word "diversity" going forward. Dr. Ho said it's a disheartening trend across the country. Even within the federal government and NASA, there are signs that it is an imminent threat. For example, the DoD, through the National Defense and Authorization Act, essentially eliminated their diversity programs, with hiring freezes across the board. NASA got a proposal, via the House budgets, that the criminal justice system agencies eliminate all the diversity offices. It's not a what if, anymore, it's at the doorstep. In the previous administration, an order went out to eliminate all diversity training and folks were caught flat-footed. NASA is thinking about it like this: what underscores and provides a foundation to much of the work is the genesis of this being around statute and regulations, the Constitution through Title VII, IX, VI; there are some things that focus on specific protected classes and by statute and regulation, we must not discriminate or harass, and they say that every agency has a proactive obligation to prevent discrimination from happening and actively promote equal opportunity. She said without a frame around how this is addressing barriers to equal opportunity, how is this preventing age discrimination…there can be a frame, but it must be rooted in statute: her office has drawn those lines. The elimination of DEI programs in academia and the private sector is where the function was more performative; the benefit of what NASA has is a true integration within the leadership that drives mission, safety culture, teams, and partnerships. She said NASA holds dear its core values and inclusion was added during the last administration, which means that no one should be left out of the conversation. Dr. Gonzales noted that, to these points, he is intentional about language and talks about "generational privilege" versus "white privilege" and what that means.

Dr. Tucker asked about the university proposals percentages and, specifically about the breakdowns and what percentages might be coming from the NASA Centers and whether, internally, NASA is leading on this. How is the fact that most of the funding goes to men at NASA Centers being taken into account in these studies and can NASA do more to lead by example? Dr. New clarified that 80% of proposals come from institutes of higher education. He said the NASA workforce is not balanced but is moving towards balance. Diversity in certain industries tend to correlate to generations and we're seeing generational shifts in terms of who is doing what at NASA. That should continue with good processes in recruitment and hiring. He spoke about interviewing strategies and techniques, including mechanisms to level the field for those. Dr. Ho added that it's more than an overnight solution. This NASA leadership has been intentional about selecting leadership. There are now female scientists in these first-ever roles. There is a recognition of the need for data for critical decisions about workforce capability. From an Agency perspective, these demographic workforce data were stored in siloes around the agency. So, there was a massive investment and effort on Dr. Ho's team to get it all on the Enterprise Data Platform (EDP) in one place and have it pushed out onto user-friendly dashboards. The 'data road show' went to leadership to show the data at the push of a button, snapshots but also trends over time, by grade level, applicant flow, and more along employee lines. She noted that the number of women in senior executive roles have been slowly increasing. Dr. Tucker asked how the Healthy and Vital Research Community for NASA Science report lined up with the NASA at a Crossroads report. Dr. New said he has not done that analysis, yet. To Dr. Tucker's other question, the table that shows the percentage of institution types that are

proposing is on page 29 of the Yearbook: educational organizations are ~60% of proposals, NASA Centers are ~15%, and non-profits are ~15%.

Dr. Cassak asked for thoughts on the focus on inclusion and not the other elements. Is the plan to expand this pilot? Dr. New said the pilot was designed to figure out what an inclusion plan means, how to evaluate it, and now to check progress. The hope is to expand it if it goes well. Dr. New said the focus on "I" and not "DEA" is related to several civil rights laws imposed on federal agencies via the Code of Federal Regulations, particularly what can and can't be considered when making grant awards; 95% of what is considered diversity is in that, so the Agency cannot evaluate for diversity for a variety of reasons. Equity is a harder concept, and accessibility is part of inclusion. If the goal is to have everyone on your team bring their most authentic self to the effort and increase the ability for the team to succeed, accessibility has to be a part of that. Dr. Cassak asked whether there had been communication with the Department of Energy (DOE), because they have a peer section – a 3-page document with every proposal – that includes inclusion and equity. Dr. New said he has not looked at that recently but, in the future, there will be benchmarking against other agencies.

Dr. Cassak said he is representing a sub-community of NASA that is struggling with horrible issues. One of his goals upon joining the advisory committee was to make sure DEI is being talked about and he appreciates the many new activities. Another goal was to ensure that women that who victims of harassment get the support they need; he said they are struggling to navigate the process and are being let down. He asked what NASA can do on the Agency side, beyond the things it's already doing, to contribute to solutions. Dr. New said the unpleasant answer is 'not very much.' If harassment, sexual assault, bullying happens at a NASA facility or involves a NASA civil servant or an onsite contractor, then NASA has means to pursue remedies. If it occurs at a university lab that is partially funded by a NASA grant, NASA has fairly limited remit. There is a movement, however, to reclassify those things as violations of scientific integrity, which would mean that complaints would invoke the whole scientific integrity machinery. Dr. Ho spoke to regulatory actions. In part, there is the question of where one goes to report an issue, and NASA and every other federal agency needs to have those avenues for reporting and let people know where to go. She said NASA has room to improve on the where to go information. NASA also partners with DOE, the Department of Education (ED), and NSF because we know those universities receive funds collectively from the federal government. So, there is a question about where to elevate if you are experiencing a challenge. Then it goes to how the university is engaged and what the remediation plans are; it's a place with room for improvement in processes.

Dr. Bagenal said she co-chaired one of the NASEM reports emphasizing career pathways and is glad they're taking that report annually. Studies show that the main dropout points, particularly among underrepresented populations, are freshman physics and freshman calculus; NASA can't do anything about that. Decadal surveys and these reports show that research experiences in undergraduate years are important for retention, and experiences such as the NSF Research Experience for Undergraduates (REU) programs have been very important. She said the committee has to urge NASA to fund research experiences for undergraduates, across the board. She asked whether there will be a formal response to the Space Board or Advisory Council for all of the recommendations for the two NASEM reports. Dr. New said a formal response will be published, and a briefing will be given to the Space Studies Board, if requested. He said there is a desire to respond to both reports together, because there is a lot of overlap and 24 or so recommendations, and some of the recommendations in the health and vitality report are difficult to find solutions for.

Dr. Hendrix asked Ms. Ho to comment on the appearance that leadership training programs seem to have diminished over the years. Ms. Ho said she would want to pull in a colleague from Human Capital, but there are leadership development programs happening at every level, for those who are potential and new first-line supervisors, aspiring and new executives, etc. NASA has created some of its own programming versus outsourcing, but that's taken a hit due to the training budget. In the NASA 2040 strategy, there was a spotlight on ensuring NASA continues to have a healthy pipeline around succession planning and leadership; those training programs will be prioritized, and every component has a DEIA piece. Ms. Ho gets funding from the Mission Support Directorate (MSD).

Dr. Hendrix asked Dr. New, with constrained budgets in PSD and a goal to get to 10% for R&A, how are these terrific programs added within the budget environment. Dr. New said MOSAICS was created with extra money from a couple of years ago, without touching R&A grants. RIA grew out of a small amount of money for what was the Research Catalyst Fund (RCF), created to co-fund proposals with divisions that met certain requirements, $5M was taken out of the SMD reserve and that was cut to $2.5M this year. MOSAICS is now a line in the budget (re: sustainability); RIA is more tenuous because it's carved out of the SMD reserve taken from bits and pieces from the Division. Dr. New would like to see RIA be adopted by each Division, eventually. Dr. Ishii asked about RIA getting adopted by Directorates and whether that goes into their R&A lines. Dr. New said it would, but he will not tell them to do it and there is no timeline for it, and if it is going to exacerbate funding shortfalls in R&A programs, he's not going to do it; but, at some level, if the goal is to diversity the research ecosystem…. Dr. Ishii said it's a small amount of money with potentially big impact, and Dr. New agreed that it has a lot of leverage.

Panel Discussion: SMD Open Science Initiatives Update

Dr. Kevin Murphy, Chief Science Data Officer, NASA SMD, began by reviewing the purpose of the Office of the Chief Science Data Officer (OCSDO) and its focus areas. He reviewed the Core Data and Computing Services goals: providing accessible data and a unified infrastructure and enabling innovation, infusion and user experience improvements.

The final report from the Data Computing and Architecture Study was released in early summer 2024. It was a comprehensive effort, including one-on-one meetings with organizations within the governmental sphere and academia to figure out how to architect the system for a variety of use cases. Those data were distilled into a reference architecture. Part of the work is taking open science requirements and infusing them into development activities and platforms, development of missions, and execution of research grants. There was a full stack of open science principles being incorporated; where things cannot be shared, they are not shared (e.g., secure or restricted data).

There were three primary goals for data science and innovation: develop a comprehensive strategy to drive innovative data science and Artificial Intelligence (AI)/Machine Learning (ML) initiatives, implement and maintain robust data services and infrastructure, and provide data governance practices and foster growth of AI/ML capabilities. For the scientific research lifecycle, data tools are critical to each phase. Dr. Murphy spoke about how data science can improve science research and the data life cycle.

The development of INDUS, a large language model (LLM) trained on scientific publications, can help create hypotheses, search data, and write research summaries. It allows a look across all open data repositories within SMD and captures about 95% of all the data through one interface. The LLM can be linked into data, software, and publication discovery tools. Dr. Hendrix asked who the INDUS customer/user is. Dr. Murphy said the user is anyone who integrates data into public discovery tools; results of data set searches would be informed

by this AI that sits underneath tools. He clarified that use can be up to the general public and will depend on integration into the variety of tools deployed over the next couple of years. For example, users may say, "Show me the fires that occurred in California," or "Show me the craters recently formed here."

Dr. Murphy spoke about foundation models (FMs) under the AI/ML 5+1 Strategy. The OCSDO will develop one FM for each division (ESD, BPS, APD, PSD, and HPD), plus one for use by all divisions. In the future, the LLM could be linked with the FM to do the queries mentioned above. The issues are how to reduce the barriers to massive data manipulation and shrink the time required to produce high quality scientific observations. Dr. Murphy noted that open science is a critical component for LLM and FM development. NASA partnered with IBM on FM development because it takes a host of expertise, which can be difficult to find, generally and at NASA; partnering in this area requires agreements about like philosophies and dedication to open science. He spoke about the Ethical AI Playbook, a collaboration with the American Geophysical Union (AGU) which is a first step to guiding principles relative to the use of AI in science. Dr. Murphy noted some reluctance in terms of adoption of AI/ML capabilities within some communities. He said the benefits of the capabilities need to be proven, which can be helped by FMs demonstrating utility in things like faster hurricane and fire models. Two models have been done, one for ESD and one for HPD. ESD will use the Harmonized Landsat Sentinel-2 (HLS) model for a variety of use cases and for their Earth Action Strategy dashboards. The future of the LLM will likely be text-based interaction with these data sets, asking questions and looking for patterns. The next phase, after 5+1, will be building additional models and having them interact. The Lunar Reconnaissance Orbiter (LRO) is next, then when ready, the Nancy Grace Roman Space Telescope (Roman). The team of AI/ML engineers at Marshall is paired with science teams to run the models. Limitations are limited staffing capacity and computational restrictions. Dr. Hendrix noted that, on all of these, there are different types of data sets, and for LRO, there are multiple instruments. She asked whether the focus is exclusively on imaging data. Dr. Murphy said yes, for right now. Landsat and LRO have similar modeling development characteristics; and, as long as they are time series signals, we can work with them.

Dr. Chelle Gentemann, Open Science Program Scientist, NASA SMD, talked about open science implementation, including funding, policy, and training. She reviewed The Research Opportunities in Space and Earth Sciences (ROSES) Program, SPD-41a Scientific Information Policy, and the Transform to Open Science (TOPS) Program. For Open Science and Data Management Plans (OSDMPs), open science is infused into grants and missions and there are requirements for the timeliness of sharing and public accessibility, along with the infusion of open science throughout mission lifecycles and its use as a road map within a living document. Whereas not everything is required to be open, it does require openness where it makes sense for transparency and science. The Open Science 101 curriculum is a community-driven training program developed by 100+ open science experts globally. There is an open science, ORCID-linked NASA badge this year. Dr. Gentemann reviewed the multi-module course. It is open where possible and closed where necessary.

Discussion

Dr. Tucker asked whether there are the resources, computing and personnel, to do this work. Dr. Murphy said in addition to development and experimentation they rely a lot on the community. For instance, there is an "open source software tools and libraries" call which identifies high-value software used by the community. There is an effort to encourage and incentivize development in the community and to reinvest in groups that do good work. The Divisions have the budgets for implementation; they are trying to provide infrastructure so the work can be done more efficiently. Funding is available and being invested in a

prioritized way to help the efficiency work. Finding the workforce can be challenging; there is a lot of competition. But making sure the personnel we have are engaged and fulfilled is partly not waiting for computational availability or access to tools.

Dr. Tucker noted that it is currently challenging to get on to the NASA Center for Climate Simulation (NCCS) and wondered how it is connecting with new systems. Dr. Murphy said they are in a deliberation phase; tiger team 1 completed in July 2024, which recommended that HEC should stand within the SMD. Tiger team 2 is starting to look at computational workloads with SMD, Aeronautics Research Mission Directorate (ARMD), ESDMD, etc., from an Agency-wide, holistic perspective.

Dr. Foster asked about efforts, considering some pushback, to do AI literacy education. Dr. Murphy said part of that is bringing together potential leaders with their science community over a high value data set. Stage 1 is finding an application that resonates with that scientific community, though workshops to identify a use case. Then, with initial models developed, they run broader workshops, for example, in spring 2024, there was a larger, fine-tuning workshop. Although it's deprioritized, a literacy program through an online platform or in-person training, similar to TOPS, will be stood up. Dr. Foster asked how hallucinations are being minimized and what the quality checks are. Dr. Murphy said, though complex, there are a variety of techniques that address that, and they are conscientious to ensure models do not give false results.

Mr. Espahbodi asked how Dr. Murphy's office is getting creative working with the commercial sector to unlock more open science initiatives. Dr. Murphy said they have participated in a number of community-backed organizations, ML Commons and AI Alliance. There is no formal program to work with VCs, for instance, but at the Earth Science Technology Forum this year, they worked to ensure representation as a portfolio for people to work with across SMD and NASA. Regarding a formal gateway for external people to access the data, Dr. Murphy said that a common search engine spans all NASA archives and all data is publicly available at EarthScienceData.gov, although it may be too complex for a novice user. Each Division also has more specific tools and catalogs of information.

Dr. Kelly Holley-Bockelmann commented on pairing discipline experts with people who understand the technology. She said, in APD, to satisfy the SD-41a rule, people release their graduate student code they wrote for data analysis. She said it might be useful to have a funding line for making code more accessible. Dr. Murphy said there is a funding line, a supplement for open science, but it's a low dollar value that people can use just to move the code over ($25-50K), to provide the money that allows time to do the work. Dr. Holley-Bockelmann said it might be cheaper to have people who can collaborate to transition the code. She noted the conversation about IDEA, in respect to high end computing (HEC), and said it would be good to reserve some part of the queue or some nodes that would be for non-R1 universities. Dr. Murphy agreed that access to computing is a barrier, especially for organizations that don't have a lot of resources. There are also a lot of security barriers to NASA systems. So, one solution is cloud contracts with major vendors and, as part of those, allocations for computational credits for distribution. There have been some problems allocating all of them, so having a prioritization related to institution type could be a solution, though it won't address all the needs. Dr. Holley-Bockelmann said it sounds like a startup allocation. Dr. Gentemann said they did a binder, for small notebooks, and a big binder, for larger ephemeral computes. Dr. Holley-Bockelmann clarified that she was talking about resources available before a grant is awarded.

Dr. Holley-Bockelmann asked how much more of an energy footprint there is now? Dr. Murphy said they are always worried about the sustainability of what the work and a lot of

the on-premises computational resources, especially at AMES, are powered by renewable energy, the hydroelectric/Shasta reservoir. In terms of commercial partnerships, that has not been part of contract stipulations at this point.

Dr. Ishii noted that as more awareness of capabilities expands, demand will grow and wondered how this organization or people outside the organization can propose to contribute and how would they integrate. Dr. Murphy said open science likes to take contributions and help coordination. There are playbooks for model development for best practices, team compositions, questions for development, etc.; it becomes difficult when a limited number of people know how to operate the resources well. It's hard to human scale, as opposed to computational scale. You need to train people and incentivize them to stay. There are partnerships being created with universities to incorporate their students into the development and there is an effort to choose people who will stay to be embedded into ML operations teams. There is more surplus on the operations side, but not always a surplus of willing scientists. Trying to form a pipeline of AI/ML talent means giving them good, interesting, hard problems. It may be beneficial to do a few more models per year to maintain a higher workforce. Dr. Ishii asked whether the funding goes through PI-led grants or how people are getting paid. Dr. Murphy said, typically, funding is through cooperative agreements with specific projects with an enduring relationship with the university. The science team members who support this are on grants. Allocation of funding for something like this is probably ~30% on the science PIs, ~30% on computation, and the remainder on the AI/ML personnel.

Dr. Hendrix asked how this community can help. Dr. Gentemann said that getting the word out about Open Science 101 is helpful because that tries to reduce the barriers to do open science. She reiterated the need to be open where it makes sense and enable reproducible, transparent science. If we're getting taxpayer dollars to do research, the return on that investment is transparency through the scientific process: the data sets, the software that can be used to reproduce results. If you provide these things, your paper will be cited more, it will increase your H-index, encourage collaborations, and widen your community. If you're open at the beginning, it's easier to be open throughout. There are many resources, including templates and FAQs, that are linked through ROSES and through the OCSDO website to help people write OSDMPs. Dr. Murphy mentioned that the Open Science 101 curriculum is being adapted into an Essentials class, for a faster rate, and is also being translated into Spanish.

Committee Discussion

Ms. Joy Burkey introduced herself, said she would be drafting F&Rs during the discussions. She presented suggested topics and suggested actions. She also had areas identified for Other F&Rs and SMD Update F&Rs.

Dr. Bakhtian asked whether there was already a finding on kudos on the disaster coordination work from the SMD update. Dr. Hendrix said that seemed like an effective program to make data useable to others in disasters. Dr. Foster strongly agreed to that finding: she said it's great to see funding being spread across various agencies, reaching across the government divide.

Dr. Ishii said there has been push from the PAC side to see some ownership of IDEA at the SMD level. She wondered whether there is value in giving Dr. New an extra job title related to IDEA. Dr. Hendrix said having a named person at the SMD level to reflect the seriousness with which the Agency is addressing this topic has come up; however, having a named person makes it easy to cut them. Dr. Ishii suggested something with "equal opportunity" in

the title, so it is not as politically charged. Dr. Bakhtian noted that the public NAC meeting included discussion about language around these topics.

Dr. Foster returned to VIPER to say that she agreed it needs to be highlighted: it is critical the current instruments stay competitive for lunar science and finding a way to repurpose the instrumentation is critical; some big ticket missions keep getting cancelled, is there a larger trend we need to be cautious of? We can narrow it to VIPER and say we support the repurposing and restructuring of how this mission gets completed. Dr. Hendrix said various problems result in cancellations of missions, and it is often due to budget; that could be a separate F&R. Dr. Foster asked about strategies for picking missions or having a different mitigation strategy if something goes wrong. Dr. Hendrix suggested that this be its own topic. She said she has heard community members say they want to keep the VIPER rover together moving forward. Dr. Fox said harvesting out the instruments is still possible. Dr. Foster suggested phrasing like 'prioritize preserving the entire mission as the preference, but you have to save the science where you can.' There was discussion about what to include in F&Rs about VIPER, including keeping the rover intact and where that funding would come from. Dr. Ishii said, until the RFI results are analyzed, any recommendation will probably not be actionable. The timeline for the RFI is this fall.

Dr. Cassak agreed that the committee should talk more about budget and missions. However, based on Ms. Ho's comments on NASA's room for growth regarding handling harassment, he suggested making a recommendation for NASA to do everything they can in support of victims in the community. There was discussion to clarify the point. Dr. Foster said they could raise the visibility regarding the process. Dr. Bakhtian said they might have the training but it's just not on the website. Mr. Gonzales said the lack of a clear path has resulted in people not doing anything; if you're a contractor, civil servant, AGU, etc., what is the path for reporting? Dr. Tucker said it's more than just a clear path for reporting, it's also education on what harassment is, feels like, and a general education about harassment/bullying/assault. It's not always clear and too many victims don't do anything.

Dr. Linda Godwin wondered whether the uncertainty about the transition of BPS from ISS to the commercial space platforms is being tracked. At the very least, it may change some priorities if there is a gap in orbital platforms for the science. Dr. Foster said many of these very relevant concerns were raised in BPAC. Dr. Hendrix said she's been concerned, particularly about cost. Dr. Foster said it will be a major throttle back of capabilities. Dr. Godwin said it was interesting to see examples on sub-orbital flights.

Dr. Tucker returned to IDEA and the 2021 Yearbook document. She said it looks like the NASA Centers have the highest selection rate by institution, but it was clear that there is a breakdown by gender diversity. Do they have the data on the NASA Centers, who their PIs are, and whether they're setting the example they're hoping to see. The Yearbook doesn't have the data broken down that way.

Dr. Bagenal suggested the first finding: Kudos to NASA for going to a yearly analysis and report on the INSPIRES data system. This is a response to requests from Decadal Surveys and NASEM reports, via the Yearbook. OMB has been pushed on changing the Personal Profile options; the finding is the remaining issue of right questions and the need for the committee to encourage NASA to keep working with OMB on the wording changes. Dr. Bagenal pointed out that the "prefer not to answer" has gone down to less than 8%, from 15%. She also wanted to encourage NASA to support undergraduate research; this has come up again in Decadal Surveys and NASEM reports. Undergraduate research is important for retention of underrepresented populations. She suggested a recommendation that NASA include broader impacts and research opportunities for undergraduates, and "de-NSF" them.

Dr. Hendrix suggested a recommendation to encourage NASA to add that into their ROSES capabilities. Dr. Foster said review panels give no points for training undergraduates and doing these engagement activities. Maybe there could be a revision to proposal evaluation, a component of the score that could be boosted by these activities. Dr. Bagenal said there is a need to keep a clear the difference between separate, undergraduate research experience and "STEM engagement." Dr. Foster suggested stripping the words "broader impacts" and focusing on undergraduate/graduate research. Dr. Bagenal said could talk to the Space Studies Board and the National Academies. The committee needs NASA to report back what they've activated in terms of recommendations. Dr. Hendrix will work to get a response from NASA. However, this committee thinks it's important to see NASA's responses to the NASEM reports, and that could be a finding. Dr. Hendrix said there's a new category for use with F&Rs called "observations," which may be hard to distinguish from findings on this committee. There was a request for the definitions of each of these terms, and Dr. Hendrix said there is a draft of those definitions and use of different language between committees. Dr. Bakhtian reminded the team that there is a difference between making recommendations to SMD versus NASA.

Dr. Holley-Bockelmann said you could call "broader impacts" "workforce development" or "workforce training." For the DAC, she usually has committees talk about what they're doing for workforce development. Dr. Bagenal expressed concern about language and wanted to ensure that undergraduates were specifically addressed regarding the drop-off for underrepresented populations. Dr. Hendrix suggested making a finding about undergraduates falling through the cracks.

There was discussion about fine-tuning the F&Rs.

Dr. Holley-Bockelmann said people do need more support and a proper protocol for reporting harassment/bullying/assault but wanted to do more: during the annual reporting of grants, there may be an evaluation of the work environment of that PI and maybe a potential to lose grants based on that reporting. The recommendation could be that SMD investigate or study ways to ensure that the environment is inclusive. Dr. Cassak liked the idea but said SMD would probably push back on doing investigations. There was discussion about NASA's responsibilities and whether just having a clear reporting structure and protocol is not enough. Dr. Hendrix asked whether there is a code of conduct for proposals and acceptance of NASA grants. Mr. Gonzales said that having a code of conduct could help. Dr. Cassak said he would support a finding or recommendation about the potential to reclassify harassment as connected to scientific integrity at risk of funding. He clarified what the suggestion would be for a protocol for reporting and there was more discussion about the code of conduct. Dr. Hendrix suggested that the code of conduct could identify the umbrella of scientific integrity. Dr. Holley-Bockelmann suggested making allocations prioritized to non-R1 institutions for the research activation section of IDEA. "To have more equity in open science initiatives, SMD should investigate mechanisms to give access to under-resourced institutions and access to HEC and compute. Dr. Ishii mentioned discussions about what NASA can do to penalize abusers; from the legal side it's almost impossible for non-NASA employees. There was discussion of using "pathways" rather than "pipeline" or "workforce development." There was further discussion about the recommendation to encourage NASA to come up with a code of conduct for grantees. Dr. Ishii said legal does not like codes of conduct, but the scientific integrity path seems more likely. Mr. Gonzales suggested asking for codes of conduct. There was wordsmithing to incorporate both. Dr. Hendrix said the desired end might be some way for NASA to revoke a grant. Dr. Cassak remembered a law about if someone committed a Title IX violation at their home institution, it would have to be reported to the funding agency, but that could lead to a disincentive to reporting. Mr. Gonzales said victims may avoid workshops and

events where their perpetrator is there. Dr. Cassak expressed concern about inclusivity being highlighted at the expense of the other items. Do other people think it's worth including equity? Dr. Hendrix reiterated that SMD calls it IDEA because SMD thinks "I" is the most important. There was discussion about labels and titles and a note that at Goddard it's called diversity, equity, inclusion, and accessibility.

Mr. Espahbodi would like a finding to expand more on ways for open science to engage more with industry. The term is "vertical LLM agents." Dr. Hendrix said, regarding the cross-section between AI and open science, that the NAC heard from Mr. David Salvagnini, the new NASA Chief AI Officer. Mr. Espahbodi said he was thinking about the Space Act Agreement with IBM and linking it with more entrepreneurial, venture-backed entities and do equal agreements to promote more creative use cases. Dr. Bakhtian clarified that the discussion was about advancing science to technology and up the TRL scale and asked whether the committee should ask for a briefing with several speakers to have a better picture, and then do a series of F&Rs based on that. Mr. Espahbodi agreed and recommended Mr. Salvagnini, Ms. Jen Gustetic, and maybe Carolyn Mercer. Dr. Foster asked whether there are enough community-driven advances or is it just NASA researchers, and whether there is a desire for more open calls or an AI-specific call? Mr. Espahbodi said, when discussing "AI" with NASA scientists, they tend to reference papers published in the 80s; he was referring to the superficial industry perspective on opportunities to build new products and capitalize on the data to invite more collaborations. Dr. Foster said the University of Florida has a massive AI initiative across all departments and wondered whether more engagement with the research community at academic centers could facilitate this process. She wondered could there be better pathways, that capture a wider swatch of the NASA research community, to create better tools. Mr. Espahbodi would like to find ways to match research to more commercial collaboration and see more lab to market initiatives and matched private funding to public spending. Dr. Bakhtian said she'd ask Dr. Clayton Turner, Acting AA from STMD, to get to the connection between science and technology and moving up the TRL ladder.

Ms. Burkey suggested pulling the draft outcomes to a separate file to send to the committee for review.

Adjournment
The meeting adjourned at 5:30 p.m.

October 9, 2024

Call to Order/Summary of Agenda
Dr. Nathan Boll called the meeting to order and reiterated the administrative details for the meeting. Dr. Hendrix welcomed everyone and reviewed the agenda.

Division Advisory Committee (DAC) Chair Reports
Heliophysics Advisory Committee (HPAC)
Dr. Cassak, Chair of HPAC, reviewed the committee members and mentioned that it was a diverse group of people representing different research areas. He reviewed the agenda items from the June 2024 meeting, the only one since the last SC meeting. The next meeting is in late October 2024.

With a new Division Director, Dr. Joe Westlake, the committee is recalibrating the advisory approach for HPD. They have discussed improving efficiency and productivity and the concern that there are too many F&Rs, which resulted in a new category of "Kudos, Feedback, Notes, and Requests" for items for which a formal response is not necessary. Another new category is "Suggested Agenda Items for the Next HPAC Meeting (As of Now)."

Dr. Cassak drew an analogy between ESD's Earth Action Program and the Space Weather Council. He said there are overlapping interests and opportunities for collaboration between the two. He also noted that the Artemis program is run through PSD, and SWC needs to stay informed.

A summary of the remaining HPD F&Rs relevant to the SC included R&A proposal pressure, metrics to measure the health of the HP R&A Program, the proposed HP System Observatory (HSO) Extended Mission Framework, and legacy data.

There was a detailed discussion about the R&A Program and the experience of proposal pressure. The funding is falling relative to inflation and the number of proposals has been increasing. There are many grassroots meetings that support many students, and there have been significant increases in attendance at those meetings. In the same time period, (since 2017), the budget has decreased. Solutions to proposal pressure are not immediately apparent and it continues to be a concern. There have been issues getting metrics on the R&A program, so HPAC could provide advice; they codified with HPD what metrics they would need.

HPD has a number of upcoming missions, legacy and extended missions, and there is work to codify how to go about ramping down missions and working with the community to do it successfully. There was discussion about the use of the term "infrastructure" and what that means and how else to frame this.

Dr. Cassak followed up on a comment from the previous SC meeting regarding concern about HPD funding CubeSat missions in relation to a burden on the Deep Space Network (DSN): The HPAC thought this wasn't a concern because most CubeSats use the Near Space Network, not the DSN.

Dr. Cassak talked about the status of GDC – a flagship mission right now – and the recommendation in the Presidential Budget Request to cancel the mission. It was restored last year with a directive to present a report on what it would take to achieve the launch this decade. The report has been submitted; there is no response to date.

The HPD Decadal Survey is going through review at the National Academies; it should be public before Thanksgiving. And there is an upcoming meeting topic for HPAC regarding the inappropriate treatment of minoritized members (especially women).

Discussion
Mr. Gonzales thanked Dr. Cassak for his focus on topic of inappropriate treatment and suggested they talk offline about personal circumstances. Dr. Foster asked for a reminder of the HPD budget and what percent the R&A budget is. Dr. Cassak said the HPD budget is close to $800M and fractions going to R&A are hard to calculate because they exist as small pockets. Dr. Bagenal asked about metrics needed to measure health. Dr. Cassak said suggestions include the funding rate by proposal grade. Things like career stage are a little harder to get. Dr. Bagenal suggested looking at the HP section of the Yearbook, and Dr. Cassak said they looked at the Yearbook two meetings prior and he was impressed that things like funding rate by gender were reasonable compared to other divisions. Dr. Holley-Bockelmann said she will probably use the idea of a 10-minute report out of the NAC discussion and thanked Dr. Bagenal for her work on the Decadal.

Astrophysics Advisory Committee (APAC)
Dr. Holley-Bockelmann, Chair of APAC, reviewed the members of the committee and highlighted the variety of expertise: computational/AI, technologists, high energy observers, optical/OIR, industry, and discipline. She reviewed the agenda from the most recent meeting in July 2024. The next meeting is in November 2024.

Dr. Holley-Bockelmann spoke about the Operation Paradigm Change Review (OPCR), which was concerning in a number of ways. Hubble Space Telescope (Hubble) and Chandra X-ray Observatory (Chandra) are faced with huge budget cuts and there was no way to maintain Chandra as a viable mission. OPCR, a non-FACA committee that was stood up in April 2024, gave a report in May 2024 about how to ramp down these missions. Chandra and Hubble are both in good health, over-subscribed by factors of 6, operations are highly streamlined, so ending them would have a huge impact on science and the community. Dr. Holley-Bockelmann then reviewed the budget outlooks for each mission. For Hubble, the committee explored four options (3 in-guide/maintaining operations with some cuts of instruments; 1 an over-guide/more money). For Chandra there was a much more significant issue, starting with $68M and heading towards $26M – there is no way to operate Chandra in this budget envelope. Of the four options, option 1 was to close the mission; options 2, 3, and 4 were all over-guides/more money that would change the way the mission operates into basically a survey instrument, with some exceptions.

The FINESST Working Group findings included the proposal rate, number of proposals, and selection rate. FINESST is the biggest proposal in AP in terms of demand, which the committee decided is unsustainable. Of the R1s, just over half end up proposing; for R2s, most do not propose. The APAC decided this is not in line with Decadal recommendations: the program is not hitting the kinds of institutions necessary for diversity of thought and more equity. There is a proposal for a new APD-focused fellowship program, the Student Astrophysics Research Grant (STAR), a two-tier system for master's or early PhD students and those far along in what they want to do. There was a discussion of limits per organization.

Dr. Holley-Bockelmann reviewed the findings from the most recent APAC meeting. She noted that they do findings, recommendations, and requests for information. Regarding Chandra/Hubble findings, a decision is being made whether to cut or curtail one or two of the great observatories quickly or without oversight; the Federal Advisory Committee needed to be consulted. Right now, the community is having some trust issues and APAC

could be charged with communicating with the community about these decisions. Sometimes a nimble result is needed but doing this while still under a Presidential Budget Request may not be the best choice. Chandra/Hubble recommendations include keeping budget cuts to a minimum to avoid big layoffs of x-ray personnel and closing out an observatory that is still working and over-subscribed, and that APD take no irreversible action until there's more clarity about the FY25 review. Going forward APAC is recommending more transparency for large changes to budget or priorities. APAC liked and appreciated the STAR Grant, specifically having two tracks so each track is treated equitably, increasing the award amount and having a full panel review, and requiring full budgets only from students who receive the award.

Discussion
Regarding the two big topics of R&A and FINESST and extended missions, Dr. Hendrix asked whether Chandra and Hubble went through a senior review process. Dr. Holley-Bockelmann said they did, and both received high ratings; with the potential for a huge budget cut, APD is planning to that by instituting the OPCR with the goal to figure out how to cut the two missions. Responding to Dr. Hendrix, she said she though the head of APD stood up the OPCR, but he may have been directed by SMD. APAC was not involved in the stand up. APAC asked to have the OPCR review in public and were allowed to comment on it when it was presented.

Dr. Foster asked, with the new STAR Grant, whether APD will pull out of FINESST to avoid confusion, or whether FINESST could have two tiers across SMD. Dr. Holley-Bockelmann said that would be great, but APAC only advises APD. In the next round, there will be both opportunities in APD, and beyond that is unknown. There was agreement about the potential for confusion.

Biological and Physical Sciences Advisory Committee (BPAC)
Dr. Foster, Chair of BPAC noted that BPAC is relatively new, and BPS moved from Human Exploration and Operations Research Advisory Committee (HEORAC) into SMD in late 2020. She reviewed the members of the committee and highlighted the range of expertise among them.

She reviewed the list of recent and upcoming meetings. There was a Government Performance and Results Act Modernization Act (GPRAMA) meeting of experts in December 2023 and the first official BPAC meeting in April 2024; the next meeting is in November 2024.

At the first meeting, there was discussion about the Decadal Survey update and the BPS response to it. BPAC received updates on the health and use of the ISS and the potential transition to LEO destinations, the Space Biology Program, Fluids Combustion Materials Program, and Fundamental Physics and Soft Matter Program.

Dr. Foster gave highlights on the committee's F&Rs. She said the Decadal is a great roadmap but noted that it requested an amount of science 10x bigger than the actual budget. There were findings about how BPS will catalyze its investment to serve the research community, the potential risk of technical and schedule delays due to limited budget, and potential impacts to science based on planned cuts to the ISS operating budget. BPAC recommended advocating for funding increases of about 30%, ensuring transparency in road mapping efforts, maintaining proposal cycles that include ground-based research, and building partnerships across NASA and with other agencies to maximize use of resources.

There was a finding that BPAC was concerned with the speed of the Decadal timeline for the research community to align proposed activities before the next grant cycle. Recommendations about road mapping and implementation included communication with the community to provide guidance, coordination with other SMD divisions and directorates, considering moving key ground analogs and facilities outside of the NASA Centers. BPAC is hoping to hear BPS response on priorities at the November 2024 meeting.

Regarding information and data exchange with commercial providers, BPAC is worried about the transition from ISS, with a sunset date of 2030, which means a 2028 stoppage of new work for focus on backlog. The transition to LEO is worrisome and BPAC feels there isn't enough communication happening about operational issues within NASA. Findings addressed that concern and included concern about the speed with which commercial LEO destinations (CLDs) achieve operational status, the need to ensure best practices are transferred, and the need to advocate for more communications and data sharing with CLDs. Recommendations included the needs for transparent and rapid communication with CLDs, access to all data from test flights and experiments related to BPS research, and assessment and identification of potential CLD external schedule and priority impacts on BPS research.

BPAC wants to ensure that as much science as possible gets done aboard ISS and the wrote a finding about that. It has recommended the creation of a pipeline of "on-demand" science experiments and help with procurement models that facilitate rapid development of hardware to delegate approval authority to lower levels.

BPAC is concerned about workforce development, specifically gaps in research funding and the threat to a generation of students and workforce training. Recommendations for BPS assistance included videos highlighting BPS achievements, partnership with the NASA Office of STEM Engagement, and leveraging of the FINESST program.

BPAC found that there is a need for increased infrastructure (beyond ISS) for BPS access to partial gravity drop towers, and that future platforms must have the necessary infrastructure to support lines of research. The committee recommended a specific funding request from Congress to construct a partial gravity drop tower/facility, leverage partnerships between NASA and ESA for potential co-funding and enhanced international participation, leverage provision of new types of environments for quantum science and technology development and explore joint proposal for soft matter and fluid dynamics.

Discussion
Dr. Godwin asked how much the commercial stations talk with NASA about what interfaces NASA would like. Dr. Foster said they are modular and can be expanded, but there will be a huge throttle back on size and instrumentation and a need to prioritize which instruments go first. Dr. Godwin asked whether there will be efforts to bring hardware down. Dr. Foster said nothing is coming back. She doesn't think the CAL can come back. In general, maybe one or two strategic pieces. Only SpaceX could really do that right now. Dr. Foster said they are building the spacecraft to bring ISS down in a controlled manner. Dr. Godwin asked whether they are looking at how to spread that out…a National Lab concept? Dr. Foster: I don't think the National Lab concept will go away; how it will manifest on a new destination is being worked out. It's been a successful effort for the National Lab and also allows NASA to stay competitive in the global LEO community now. Dr. Godwin said there is a need to come up with a list of presentations for future meetings. Dr. Foster agreed and offered email communication to take questions or ideas back.

Earth Science Advisory Committee (ESAC)

Dr. Tucker, Chair, Earth Science Advisory Committee (ESAC), began with a review of the committee members, including new members that came aboard in November 2023. There was a full meeting in April 2024. Earth Science is a diverse field, and they have new members from many areas including atmospheric chemistry, atmospheric weather, climate, oceanography. Dr. Tucker will be rolling off at the end of October 2024; a new chair is to be determined.

Dr. Tucker reviewed the April 2024 meeting, which had 12 presentations over 2 days. The first day was held jointly with the Applied Sciences Advisory Committee, a subcommittee of the ESAC with its own designated officer and meeting and separate reporting to ESD. There was both content overlap and different priorities.

The new Earth Science to Action (ES2A) Strategy is an effort to ensure that data that are globally important is addressing user needs; this is the context for an F&R related to this strategy. The main finding was that NASA is a national strategic asset in terms of ES observations; critical for helping us understand what's happening and how to adapt to it.

Recommendations related to ES2A were, briefly, to ensure that NASA doesn't replicate or conflict with work being done at sister agencies; to develop a deliberate and empathic roll out of the strategy to the larger community, considering the history of other agencies doing this work and maintaining clarity around what and why NASA is doing this work now; and take care that the activity doesn't impact negatively NASA's fundamental science mission.

Dr. Tucker reviewed details of the Earth System Observatory (ESO), which came out of the 2017 Decadal Survey. She spoke about the core Designated Observable missions, including the four Phase A selections, and planned changes to missions. She said ESO budgets are tight and described the "Decouple, Partner, and Compete" approach that came out of the ESO Review Board to reduce cost and scope without canceling a major mission area. There is a move from tightly coupled architecture to decoupled architecture.

Dr. Tucker highlighted F&Rs for ESO. There was a finding about the value of the decouple, partner, and (potential) compete to these Designated Observable missions: there is a benefit in terms of cost savings but concern with risks to the ability to deliver new and improved science and in working with external partners while maintaining control and mission assurance. There was a recommendation that NASA should work towards transparency in the new ESO strategy, ensuring the community stays informed, and understanding the risks of new approach. There was a finding that the lack of an ES Decadal Survey mid-term review/report raises concerns about the frequency/infrequency and in/flexibility for the field of Earth science, considering the rapidly changing world.

EPAC was happy with the R&A area, where ESD has a strong record of important scientific discovery. There was discussion about shifts in the way the Earth Venture suborbital proposal process works: moving towards PIs proposing ideas and, if those science ideas are selected, they can work with PIs to identify the rest of the team, which could decrease the burden to PI entry. There was a recommendation that ESD R&A should continue efforts regarding the dual anonymous peer review and encouragement of breadth and diversity in science team formation to engage students and faculty at minority-serving institutions. And there was a finding regarding the importance of a modeling strategy that recognizes the fundamental importance of observations as a guide to traditional and machine-learning modeling activities.

Dr. Tucker highlighted F&Rs for Computing and Data, including a finding that all computing needs are not equal and increasing amounts of data will require more resources; in addition,

ESD's HEC capabilities are at maximum capacity and aging. Recommendations included the ESD need to develop a way to assess and capture HEC computing needs to execute on the ES2A strategy; and, in working towards Open Source Science, ensure that data and computing are co-located where users can log in and work locally.

Finally, Dr. Tucker highlighted F&Rs for Digital Twins (DTs) and ESO Data Integration. One finding was a recognition of the importance of DTs and support for activities being developed at NASA. A related recommendation was, in the development of the DT framework, to clearly define and prioritize application scenarios for a number of reasons. Another finding recognized the value of thinking holistically about ESO missions and future data integration opportunities. There was a recommendation to accommodate the use of data from across the international portfolio of Earth observations. A finding noted the multiple communication layers at different Centers and potential information silos. And there was a recommendation that ESD present at a future ESAC meeting regarding needs and status of computing at ESD.

There will be a GPRAMA annual report review in October 2024 and the 2025 meeting is to be scheduled.

Discussion
Dr. Hendrix sought to clarify the recent meeting history of the committee. Dr. Tucker verified that the previous meetings were August 2022, April 2024, and the upcoming October 2024.

Planetary Science Advisory Committee (PAC)
Dr. Ishii, Chair of PAC, began with a review of PAC membership: she will roll off at the end of 2024 and Shannon Curry will take over the chair role in 2025; Katie Robinson will take over from Ryan Watkins as the Executive Secretary. Dr. Ishii thanked members whose committee membership is ending for their service. The PAC meets 3x/year for regular meetings and once for GPRAMA assessments. There have been two PAC meetings since the last NAC SC presentation (including the September GPRAMA meeting) and the next meeting is mid-November 2024. Dr. Ishii reviewed the most recent PAC GPRAMA discussion and unanimous vote on NASA performance goals for the GPRAMA Science Evaluation.

Dr. Ishii noted that, regarding PAC F&Rs, PSD is not required to make a formal response to findings without recommendations. Then, she highlighted findings and recommendations from the March 2024 meeting and some PSD responses. A finding about the Deep Space Network (DSN) as a critical resource, with capability that is likely to be insufficient to meet both Artemis and PS needs, garnered a response from PSD that created optimism that the increased spotlight on DSN issues to senior Agency leadership will result in fruitful changes and risk mitigation for SMD and Planetary missions. The PAC made a recommendation about strategic planning and resource development to efficiently leverage DSN capacity.

Another high level finding related to Mars Sample Return (MSR), which has serious budget and schedule issues. The finding noted that projected demand exceeds current and planned capacity. The PAC recommended that, in addition to documentation and explicit inclusion of benefits of MSR in the M2M program, that MSR be elevated to an agency-level priority. Dr. Ishii said MSR is also a possible national posture issue and viewing it this way could allow for allocation of more resources.

Another finding was about the critical importance of the Antarctic Search for Meteorites (ANSMET) Program to planetary science research and missions. The recommendation encourages NASA to re-engage NSF logistical support for ANSMET and, failing that, to explore alternative logistical support to ensure continuity of the ANSMET Program.

The final highlighted finding was regarding nuclear fission-based power and propulsion technologies have singular potential to increase our space exploration capabilities. The PAC encouraged NASA to continue supporting industry efforts to develop these systems for terrestrial and lunar systems.

Topics that have been requested for discussion at the November 2024 meeting are, briefly, MSR and Mars Exploration Program; Clipper and the vendor MOSFET issue; ESSIO/Lunar and VIPER update; Dragonfly; SIMPLEX; EnVision; NASEM report on NASA Mission Critical Workforce…, particularly DSN; PSD status regarding NASEM report on IDEA; NSSC communication issues.

Dr. Ishii reviewed Planetary Science Budget Priorities for FY25 that are guiding PSD decision making. Priorities from the PSD perspective include the following: complete Europa Clipper, NEO Surveyor, and Dragonfly; support international partnerships; ensure Decadal-recommended science investigation in Artemis; and support the PS research community. She reviewed Dragonfly and VIPER details and Back to Venus and Europa Clipper dates and plans. Europa Clipper will hopefully launch in mid-October 2024 and reach Jupiter Orbit Insertion in April 2030.

Discussion
Dr. Hendrix asked when the VIPER information was provided to the PAC by PSD and whether NASA was reviewing the VIPER proposals. Dr. Ishii clarified that the VIPER information was received from PSD in late September and that NASA received the VIPER proposals in early September, which are still being assessed.

Dr. Ishii added that, from the PAC perspective, the high priority topics are DSN, MSR, and VIPER – and that maybe a recommendation for VIPER isn't necessary as long as there's emphasis about the level of concern from the community. Dr. Hendrix said the NAC just approved the SC's F&Rs on DSN, so the committee should discuss whether or not they should push that topic again, given the previous emphasis and its importance already noted in the Crossroads report. Then, regarding the national posture for MSR, Dr. Ishii said perhaps Congress would provide additional funding if MSR is named a national posture priority.

Dr. Foster asked if VIPER was cancelled by SMD. Dr. Ishii confirmed that VIPER was cancelled by SMD due to SMD funding constraints, including future risks, high costs, and potential delays. It was an internal decision complicated by budget lines. There has been a grassroots push towards resurrection because the rover is ready to go. There was an RFI from a House committee, so there's congressional interest in understanding the decision making. Dr. Foster asked about reaching out to international partners and commercial entities. Dr. Ishii said there was an initial request for expressions of interest that went out broadly and feedback from domestic companies, international agencies, and backyard/garage enthusiasts for potential mission concepts and an RFI with a fairly short timeline. Dr. Foster wondered whether the intention was to keep the whole thing intact and Dr. Ishii responded that she didn't think there were a lot of ground rules for expectations.

Regarding PSD prioritization, Dr. Ishii said the number one priority is to support the planetary science research community to ensure continued scientific discovery from NASA mission data. Dr. Hendrix asked whether PAC had gotten an update on the numbers for the R&A budget. Dr. Ishii said there had been an update and she can report back. She added that PSD has been open and transparent with data for the PAC to the community. Dr.

Hendrix said it seemed in other divisions that the DACs haven't been getting the same level of information. Dr. Foster suggested assessing who is at what level at the next meeting.

Panel Discussion: Climate Change and Earth Systems Science Strategy

Dr. Katherine Calvin reviewed the Agency-wide Climate Strategy, which was released in March 2023. The goal of the strategy was to help coordinate efforts in climate work and communicate progress. She provided an overview of the progress towards the achievement of NASA's climate strategy and gave examples for each part of the strategy: Innovate, Inform, Inspire, and Partner. She provided four concrete examples of progress: the PACE mission focus and its broad user communities and planning information; the Earth Information Centers (EIC), of which there are now two, plus an online experience at Earth.gov; the Climate 101 curriculum for climate literacy for all staff; and the US Greenhouse Gas Center, which is an example of successful partnership and collects a large variety of data sets into one place.

Dr. Karen St. Germain, ESD Director, said the Decadal Survey from the National Academy is a principle guiding document, from 2018, which emphasized the importance of observations and also provided good scientific framing and guidance on increasing the impact of science in response to Earth changes. She talked about how ESD thinks about end-to-end capabilities to address challenges: technology development, flight missions, R&A, data and modeling, and Earth Action.

We are at a pivotal moment, with rapid changes in parts of the Earth system and a dramatic increase in the demand for understanding and information. We are moving into a golden age of Earth observation, and this moment drove the move to the ES2A strategy, which will accelerate the use of Earth science to support policy and decision-making for society's well-being. There is a search for decisions that scale, encourage bridge building, and are user-centered.

Dr. Bakhtian asked whether the strategy is under climate work or is broader. Dr. St. Germain said it is an Earth Science Enterprise strategy; it applies to all of the ways that people want to use the science, even if it's not related specifically to climate change, e.g., for the study of volcanoes and earthquake disaster relief.

Dr. St. Germain reviewed the ES Strategy Vision and Mission, specifically living in a thriving world driven by science and compelled by the planet's rapid change. Some of the work is already being done, but there is recognition that, with climate change, traditional tools are no longer effective for some users (e.g., commodity farmers), who are asking for different tools focused on acceleration of learning and foresight.

Dr. St. Germain reviewed the strategic goal and major objectives and their Key Results (some intended to be completed with partners): holistically observe, monitor and understand the Earth system (with a key result to integrate data); and deliver trusted information to drive Earth resilience activities. The ES2A strategy was guided by the Decadal survey. The strategy's guiding principles include enhanced partnerships, a diverse workforce, a balanced approach to competing factors, innovation, and robustness and resilience in the programs. Dr. St. Germain gave several examples to showcase the strategy's impact: the pyramid structure of the ES2A strategy, which is a cycle of feedback loops from different areas; the NASA-USGS Geological Earth Mapping Experiment (GEMx) Campaign, which is a contribution to the Clean Energy Act of 2020 and climate change mitigation, and has data that is openly available, Tribal engagement efforts, and development informed by user needs. Partnerships are embedded throughout and in all tiers of the strategy. There are agreements with government/federal agencies, multiple

commercial agencies, and non-profits; and international non-profits, organizations, and space agencies.

Next, Dr. St. Germain reviewed the NASA ES fleet. The missions that launched long ago are all within 2 years of decommissioning. The missions being built today must come on line by the time the earlier missions are ready to retire. She reviewed the missions in development. Upcoming missions are critical for the future of ES, which is open to advice to increase support for the advancement of those missions.

She closed with the thoughts that there is urgency to the work done in Earth science and NASA ES is uniquely positioned to do much of this work; there is a responsibility to do this work, and there is a request to the community to take ownership of this mission space.

Discussion

Dr. Hendrix asked how SMD fits into the NASA agency-wide climate strategy and whether an overall structure and strategy for all the measurements from NASA, NOAA, and other partners is part of the NASA strategy or is inter-agency. She also asked to hear more about the new subcommittee on climate services. Dr. Calvin said that the climate strategy is agency-wide, ES has a big portion of the work, but the strategy is about understanding and informing people about climate. Other parts of NASA are developing mitigating technologies and, within our mission support in centers and facilities, they're addressing the challenges of climate change every day. The Subcommittee on Climate Services was stood up within the last year and was a Fast Track Action Subcommittee out of the White House about how to provide information to the American public about climate change in a way that's actionable. All of the agencies with a role in climate services (providers and users) are meeting to talk about planning and coordination. There is a lot of potential to help cross-government to provide information to people. There is another decades-old subcommittee on research focused on information provision. Dr. St. Germain said other agencies making space-based, ground-based, surface-based, airborne, and shipborne observations are USGS, NOAA, and EPA and that their observations are largely linked to primary missions and central functions; NASA's mission is about advancing the entirety of Earth science. Coordination is largely through the U.S. Group on Earth Observations (USGEO) coordination body, which is where the Satellite Needs Working Group runs. Agencies bring needs to the committee for assessment. The Decadal Survey also addresses NASA, USGS, and NOAA and provides advice on coordination. The is a periodic National Plan for Civil Earth Observations, developed by OSTP and USGEO, that is in the process of vetting now. Additionally, NASA and NOAA, for example, have probably 100 active collaborations in research, building new data and information products. One of the most recent was the Sea Level Rise Portal, a multi-agency (~12) effort to produce a single domestic sea level rise portal with authoritative information and engagement of all the agencies.

Dr. Foster asked whether the subcommittee from the White House helped the start of building international and commercial partnerships. Dr. Calvin said the subcommittee is new and is about coordinating within the US government; many NASA's partnerships with international and commercial are decades-old. Dr. St. Germain added that many of those partnerships are executed out of the ESD, and NASA has over 100 international partnerships; a subset of those are actually involved in building missions, the remainder are about the use of observations and tools.

In response to a question about the future of ISS missions and whether there is any effort to continue the instrumentation on commercial destinations after the life of ISS, Dr. St. Germain said the ISS has been a great resource to get instruments into LEO affordably; she didn't think any of those instruments can be removed and relocated to a commercial

platform. With many unknowns, her job is to get the most science she can with the budget she has. There are free fliers now. ESD is engaged in the conversation and hopes it provides an affordable platform to quickly get missions into LEO.

Dr. Bakhtian said this administration recognizes that climate change is a challenge for generations to come and has an exciting vision and objectives; she assumed the NASA strategy would mimic that and be clear about how they can build toward that and move the needle. She asked which part of the excellent Progress Towards Achieving NASA's Climate Strategy slide is the strategic part. Dr. Calvin clarified that the goal of the NASA Climate Strategy was about how NASA's mission is relevant to climate and what the Agency is undertaking; a lot of NASA's mission is providing information, understanding, and technology to the world. There is an element about how NASA is addressing climate change within its operation space, because NASA's mandate is around research and technology. Regarding NASA's facilities, NASA does report on sustainability, but the NASA strategy is broader. Dr. Bakhtian said the U.S. Greenhouse Gas Center is part of the structure thinking about how to be ready for the tools of the future, such as AI/ML. Dr. Calvin said that overall, they are looking at how AI/ML can help NASA ES and climate. Dr. St. Germain said they are exploring things like foundation models (FMs). She highlighted ways that data is managed to make it readily usable by these tools (e.g., work related to the library of meta-data). There is an effort to standardize best practices to enable a variety of solutions. It's expected that AI/ML will be useful in the future, but it is currently in the research space. Dr. Bakhtian commented that the strategic goals slide makes it look like it's all about resilience, but the administration is more focused on mitigation. Dr. St. Germain said they are trying to make this statement inclusive, and it is not intended to exclude uses of the information for mitigation. Dr. Bakhtian asked about the metrics for the Objectives and Results? Dr. St. Germain said ES is working on implementation and an upcoming meeting will focus on that. ES is using the term "accountability" because not all of these results lend themselves to metrics. Dr. Calvin noted the discussion in creating the strategy about whether to identify metrics; they found that communicating information doesn't lend itself to measurement. Dr. Bakhtian asked, regarding partnerships and the Earth fleet, whether NASA is leading on coordinating, collaborating, and coming up with the plan, especially on the Earth Observations side, so we all feel confident that we're in sync with what others are doing. Dr. St. Germain said, on the international front, the principal mechanism is the Committee on Earth Observing Satellites (CEOS), which is comprised of 36 countries in the Earth observing business from space; NASA is a leader of that organization, including having chaired it and now chairing the working arm. CEOS doesn't dictate bi-lateral/multi-lateral agreements. CGMS is focused on meteorological satellites, NOAA is the leader/NASA plays a supporting role. The dynamics of commercial space are different, including planning timelines, so that is handled through direct engagement, industry days, and RFIs, for example.

Mr. Espahbodi, a venture capital (VC) investor, commented on forecasting on the commercial side, which he noted includes the AI space. He asked, as more companies are getting creative, what is the most visionary wish list around the collaboration of AI tools for ES? Dr. St. Germain said we've seen these kinds of Wild West leaps forward in the past and right now the focus is on determining the sets of problems this capability can help with. There is an Applied Science Advisory Committee (ASAC) that is going after FMs. A single FM may be able to enable a whole range of application tools quickly. Mr. Espahbodi suggested a slide in the future about not just how AI tools will augment scientific research, but also how some of those bold businesses are unburdening you. Dr. Calvin said AI/ML is being thought about in the context of climate modeling: can it be used for higher resolution information and projections? There is also ongoing work on whether it is possible to improve our representation of the future climate. From commercial, there is a lot of expertise and

resources in high performance computing and experience using AI/ML more that are probably worth exploring. Mr. Espahbodi said he'd also encourage exploring more on the analytic side, as well.

Dr. Waleed Abdalati offered a perspective from someone not at NASA who worked on the Decadal Survey. He complimented the Climate Action Plan. He said NASA is playing an important role in the national structure, but observations are lagging for understandable reasons. We are still in good shape because so many missions are past their design life, but they will begin fading and tapering off. He underscored the cost of deferring these efforts and the urgency that Dr. St. Germain mentioned and said the community can also convey that urgency. A challenge, from OMB to the Hill to the community, is the perception that this is not a priority that is commensurate with the urgency. It's great to talk about the EIC and the low delta costs to make the most of these capabilities. To the external community, these are small investments that will not get to the big places we need to get to. The core of all this is observations and research. There is a perception that the priorities associated with these Earth observations, given the urgency, are not reflected in the messaging. It's up to those outside of the NASA domain to convey this information as the agency can't. The main points are these are great efforts in line with what the Decadal sought, there are challenges we're all aware of, and there's a perception that it is not the priority it ought to be.

Dr. Hendrix said we know and have heard that the next suite of flagship missions are behind schedule and over cost and yet they need to replace these older missions set for decommissioning. Dr. St. Germain said it has been difficult getting the support to move on them. They have not been getting the appropriations that would allow movement in a timely way. She moved to pin this to find an effective recommendation from the SC. Dr. Abdalati said NASA should do what it can to manage that perception and push back against it at the administrator, OMB, and Hill levels. It's a good recommendation but goes beyond the SC.

Dr. Bakhtian said the agency needs to think about how to leverage agency dollars to get more industry, philanthropy, international funding, and asked whether there has been that kind of thinking for the Climate Change Strategy at NASA. Dr. Calvin said there are efforts to engage private or non-governmental actors. In Earth and Climate, there are some things that are inherently governmental, so there are various incentives and priorities and alignments may not work on the same timelines. Dr. St. Germain said there is a fair amount of work in that space and one full-time employee. There are two different types of work 1) the exploitation of existing observations and easier-to-establish partnerships; and 2) making the observations that become more challenging. Dr. Foster asked whether there was a society the team works closely with, so they can help amplify the message. She wondered if education days on the Hill, brown bag lunches, etc. (not lobbying but educating staffers) was permitted. And, she asked how the committee could help build an advocacy force. Dr. St. Germain said the United States Department of Agriculture (USDA) and the American Meteorological Society (AMS) are most closely connected to the work ES does; Dr. St. Germain must be careful about asks for action. There are town halls at every conference and thematic brown bag lunches have been held on the Hill. She said she is open to suggestions. The EIC in the Smithsonian is a large and beautiful space, so events can be held there with large and visually compelling showcases of data. She said a lot of people think AI is the answer for everything, but if you don't have data…you can't manufacture information. ES has not done a good job of capturing the entire economy of private sector and nonprofit entities making use of the high quality data to create all these value-added products and services; their voice is missing in the commercial conversation. Dr. St. Germain said an EIC will open at the Kennedy Space Center (KSC); and the plan is to create a situation where the content is available to stream and scalable to various facilities, so someone with a lobby can put it on a big screen, for example.

Panel Discussion: Space Weather Hazard Mitigation and SMD Roles

Dr. Joe Westlake, Heliophysics Division Director, NASA SMD, and Mr. Jamie Favors, HPD Space Weather Program Director, NASA SMD, began by talking about their roles and responsibilities, specifically the SMD roles within NASA. Dr. Westlake noted that the presentation was a response to the SC request for update on detection and warning capabilities for space weather events.

The National Space Weather Program (NSWP) is an interagency initiative to speed the improvement in space weather services and better prepare the nation to deal with technological vulnerabilities associated with the space environment. NSWP collaborates closely with NOAA, the Department of the Interior, NSF, and many other agencies. Although there is confusion about the work done at NASA versus NOAA, at NASA the focus is research-centric: it is the R&A arm of space weather and our ability to understand the fundamental processes coming from the sun that affect us here on Earth.

Dr. Westlake played a video about the potential impacts of a solar storm, created to explain some of the work done in the Space Weather (SW) Tabletop Exercise (TTX). The scenario was put together to look at the flavor and feeling for the potential dangers and issues in a space weather event. NASA excels at the necessary nuanced conversations and interpretation of nuances of research. He reviewed the US SW Policy and Guiding Documents: the Decadal 2013-2022, the PROSWIFT Act of 2020, and the National Space Weather Strategy and Action Plan and Implementation Plan. The next Decadal is expected in November 2024 and Dr. Westlake noted that there may be conflicting guidance or not enough support to address all the guidance.

The SW Research-to-Operations and Operations-to-Research (R2O2R) Framework fosters interagency collaborative transition of SW capabilities into operations. NASA just concluded an assessment of the process and rolled out an updated approach that will begin in February 2025. Mr. Favors spoke about the SW Operations, Research, and Mitigation (SWORM) Subcommittee. This is the interagency organization that convenes over SW in US government, working through implementation plans and activities. He noted that the Space Weather Advisory Group (SWAG) is the group that advises SWORM. He also reviewed the NASA HP Space Weather Council (SWC), which is a FACA Subcommittee to HPAC that is a community-based, interdisciplinary forum for analysis and advice. Mr. Favors then reviewed the HP missions. He said anywhere you go in the solar system, there is an interest in measurements. SW has been doing more work around the Mars environment, including observations from the Curiosity rover, which is good cross-work between Planetary Science and HP.

The NASA SW Program addresses fundamental science, applied research, and applications and is a critical partner for the nation's operational forecasting by NOAA and the US Department of Air Force (USAF). There are many similarities between space weather forecasting and terrestrial weather forecasting. There is a lot of numerical modeling on the forecasting side. Mr. Favors mentioned the work to support human exploration and NOAA Space Weather Center and NASA SRAG. He highlighted the Heliophysics Environmental and Radiation Measurement Experiment (HERMES), which will take measurements in lunar orbit and will also inform a crewed mission to Mars. There is a new approach to the R2O2R Program element within the SWP, based on assessment of the program over the last year to ensure the intent was met. The SWP has funded Centers of Excellence: Space Weather Research and Technology Applications (SPARTA), Space Weather Operational Readiness Development (SWORD), and CLEAR, which are all 5-year multidisciplinary efforts. There has also been some joint selection work with the Department of Commerce.

The Moon to Mars (M2M) SW Analysis Office is focused on supporting the work at NOAA's Space Weather Prediction Center (SWPC) and NASA's Space Radiation Analysis Group (SRAG) with human exploration missions. M2M also supports NASA robotic missions.

Mr. Favors gave his personal opinions about the current limitations and challenges for SW prediction. He said many of the things that limit the ability to forecast are not understood. There have been comparisons that suggest that space weather is where terrestrial weather was 50 years ago in terms of understanding the science.

The 2024 SW TTX was a fictitious event experienced in real-time to rehearse actions that would be undertaken in a real event. During the TTX, the largest SW event in the last 20 years began to occur. After-action and more detailed events will be in reports issued in the coming year. Mr. Favors discussed coronal mass ejections (CMEs) and said there were so many CMEs during the storm that it affected the capabilities of some models to provide accurate predictions, a limitation of the modeling. The reported impacts of the May 2024 solar storm included those in the energy sector, satellite operations, aviation, and GPS systems. The practice and notification systems helped mitigate some effects. The forecasts and lessons from the May 2024 solar storm include the recognition that, although a decade of preparedness paid off, there are still challenges remaining. There are insufficient science and operational capabilities to accurately predict geomagnetic storm intensity. And, this storm highlights the need to transform SW scales and products – this storm was at the top of the scale but didn't have the impacts that you would expect there. He mentioned the work towards new scales for SW. The May 2024 storm moved out of the Earth-active region and reached out to Mars. An estimated X-12 flare led to the largest energetic particle event measured at Mars. This underscores the importance of measurements to human exploration and the need for off-Sun-Earth-line measurements. Mr. Favors closed by discussing the missions that were able to capture the events on Mars.

Discussion

Dr. Bagenal, noting the video's interest and public education potential, wondered how to get the public to a better understanding of the physics. She said we must think about how to get heliophysics into every physics or science textbook from K–12 to college so people understand these phenomena. She encouraged the committee to think about how to expand into the educational area and maybe encourage, like NSF, the broader impacts, encouraging scientists to write contributions to textbooks, for example. Dr. Westlake said one challenge is that "heliophysics" is not in the dictionary. The HP Big Year helped. The reach that HPD had for the Great Solar Eclipse,the Aurora, and the Parker Solar Probe approach was in the millions of people across the United States. Four million people tuned into the solar eclipse, but general education about Heliophysics is a challenge. Dr. Hendrix followed up about the textbook idea and allowing research to include education in their proposals. Dr. Westlake said that is a long-standing, complicated topic with many different pieces. HPD doesn't want to reinvent the wheel and having Mr. Favors, from the ES side, on board, is a real benefit across the SMD portfolio. There is room for growth here.

Dr. Tucker noted that relationships with other organizations look good/healthy. She asked what lessons were learned from the larger relationship between NASA and NOAA on surface-based weather or what was learned that could be returned to that relationship to improve it. Mr. Favors said the natural dynamic between NOAA and NASA exists because the missions are very similar, but at a fundamental level there is a natural tension and confusion about who is doing what. The challenge in SW is the small community; there are many more users of the ES data than SW data, and that demands coordination. The May event made SWPC common language; people were showing SWPC forecasts as they show

the National Hurricane Center during terrestrial storms. There were lessons learned on language, e.g., "geo-magnetic storm" versus "solar storm." Mr. Favors gave kudos to NOAA for being so transparent, but the science is still not totally there.

Dr. Ishii asked how the radiation standards are set for the Clipper Metal-Oxide Semiconductor Field-Effect Transistor (MOSFET). Dr. Westlake said that a lot of the inter-planetary events that Clipper would see are benign compared to what would happen in the Jovian environment. The ability to understand those environments comes from the measurements over many decades. Some of those measurements for the inter-planetary environments are very good for predictions; for planetary and other environments, it is more of a struggle and uses decades-old data. Dr. Ishii asked whether the level of rad hardening needed to prevent some effects can be anticipated. Dr. Westlake said there are many environments where we've had HP assets in research and science that are no longer there. A key place is in the radiation belts and some follow-on missions to the Van Allen probes have been looking at those radiation belts and finding some new features, but we don't have the kind of detailed observations that we had when the Van Allen probes were operational. Mr. Favors said there are engineering groups within NASA and in other organizations for the rad hardening work.

Dr. Bagenal said she is on the Standing Review Board of Clipper and that it has a canary box where they put a bunch of the MOSFETs on the spacecraft and they will be measuring the radiation. This will be valuable for other missions and on the way to Jupiter and in the Jupiter environment.

Dr. Foster asked what happens after the HP Big Year ends. Dr. Westlake said PSP will continue to deliver great data. HP will take a breath; the team has been working hard and engagements in 2024 have been intense. The Great American Eclipse largely fell on HP's shoulders. He expressed a huge thank you to Kelly Korreck who led a lot of that work. Across government, everyone wanted HP expertise. He said it will take some time to ingest the information that will come from the Decadal Survey. There are a slew of launches that will allow for engagement and interaction with the public: six launches in the next 1.5 years that will boost engagement and provide a platform. There was a discussion about the goal of getting "heliophysics" into the dictionary.

Dr. Hendrix expressed appreciation for the specific callout of challenges in addressing the committee's question. She noted that some of those challenges may be addressed in the HP Decadal Survey. Mr. Favors said NOAA is part of the Decadal, as well, so it may be similar to what ES went through with applications, with SW being a more structured part of the most recent Decadal. He mentioned that the Decadal is inter-agency with NOAA and NSF. Dr. Westlake said some of the strategic missions in HP can be thought of as tying the connection between the Sun and the Earth. There was more discussion about what the Decadal Survey will provide and the anticipation of the receipt of it.

Committee Discussion

There was discussion about the process of organizing the notes for presentation to the NAC. Dr. Tucker said, in the past, F&Rs have been written for the leaders of each division, unless there was something broader than the individual division that needed to bubble up.

HPAC

There was general discussion about abridged F&Rs. Dr. Cassak did not feel any of his F&Rs needed to be advanced to the NAC. Dr. Hendrix suggested a broader topic about canceling missions and a broader topic about Crossroads and the SMD response. There was discussion

about what the SC needs to discuss regarding Crossroads. Dr. Cassak said that not addressing it tacitly endorses the recommendations. Dr. Foster said more transparency is needed regarding percentage of budget allocated to research in SMD. Dr. Holley-Bockelmann said, in APD, the Decadal did not address their dire budget situation. She said APD needed a break to do technology development, then wondered what happens with the balance of working flagship missions when that wasn't on the radar of the Decadal. Dr. Foster said, for BPAC, the Decadal said to get a 30% increase in the budget every year. She noted that sometimes the Decadals are very rosy and suggested that a recommendation could be to provide more transparency on thought processes for budget breakdowns. Dr. Hendrix said a lot of the Divisions are creating strategies to respond to the Decadal Surveys: HPD, ESD, BPS (calling it a road map), maybe APD; she didn't think PSD. Dr. Cassak thought it was required to have a road map as a response to the Decadal. Dr. Tucker said the recent strategy in ESD is one that is responding to the external need for science data and still addresses some of what was asked in the Decadal. NASA SMD has had strategies with every Division included. With new leadership there will be a new approach to strategy. There was agreement that a briefing would be good. Dr. Cassak invited fellow committee members to share the thinking in writing the Crossroads report; Dr. Tucker suggested waiting until after the briefing before diving in. Dr. Bagenal, a reviewer of the report, was concerned that it was all about the Centers and there was limited discussion about other institutions' funding and support. She is concerned about workforce development if all the money goes to the Centers. Dr. Ishii suggested a recommendation to ask for a briefing next time. Dr. Tucker agreed. Dr. Hendrix said there is also a desire to understand SMD's response to it. Dr. Hendrix said the R&A topic comes out of the Crossroads report. It's important to understand R&A budgets for each division, and selection rates – independent of Crossroads, the committee needs to talk about R&A from each Division. Perhaps each DAC could get that information and bring it to the committee. There was discussion to drill down to DAC Chair Reports – Fall 2024 (cross-cutting) F&Rs.

Dr. Foster asked about each Division providing input on how much they rely on the DSN, for cost evaluation and cost sharing. Dr. Ishii was just thinking of whether SCaN wants to get involved…and translate that into an appropriate usage plan. Dr. Cassak said, regarding the Crossroads report, he liked the phrase "don't do anything irreversible" and asked whether the committee could make that a finding. Dr. Hendrix is hearing the concern that missions will be cancelled just based on the Crossroads recommendations. Dr. Bakhtian suggested wording committee recommendations to ensure that action is taken concurrently rather than potentially slowing things down. Dr. Tucker said DSN is not necessarily a priority in ES; although it serves an important role, it may not be a cross-cutting area.

There was a move to capture items for discussion without attempting to resolve items during this meeting.

Dr. Bakhtian noted the conversation about technology and suggested a request for a briefing from STMD. Dr. Hendrix agreed and thought a briefing on AI would be good, specifically by the Chief AI Officer, Mr. Salvagnini. Dr. Bakhtian recommended a more general technology briefing, e.g., the transfer of science to technology, lab to market, etc. Dr. Tucker said each Division has their own technology areas and there is a need for clarity on the request specific to Divisions. Mr. Espahbodi wanted to gain understanding of how the SBIR office is thinking about prioritizing those initiatives through procurement.

Dr. Holley-Bockelmann said, from APAC, mission cancellation is part of the cross-cutting point, and APAC would like more transparency. She would like to bubble up the FINESST fellowship and is interested in finding out how to make it APAC-specific; she suggested taking it to NAC because SMD may like to adopt some of those priorities.

Dr. Foster said, for BPAC, there is nothing to elevate to NAC except for maybe a request for a briefing on ILDs/CLDs at the NAC level, based on the gaps detected at the April BPAC meeting. She suggested inviting Jennifer Buckley from ISS, Mike Roberts from the CASIS-National Lab, and Curt Costello to talk about the transition.

Dr. Tucker said, for ESAC, she'd like to bubble up the computing and data availability impact and noted it could be cross-cutting. She touched on the massive amount of ES data, the need for computing to start building high performing models, and AI and trying to use the data in new ways. For the report on high-end computing, NASA was far down the list on capabilities. At the very least, NASA should present to the NAC SC committee not just on open source and data availability but also on computing needs and power and the people who can do it. Dr. Tucker suggested someone out of Dr. Murphy's office. It was mentioned that, often, AI and high-performance computing are not connected.

Dr. Ishii said, for PAC, she sees the MSR being elevated to agency level/NAC. ANSMET is an inter-agency conversation, so it needs to happen at high levels, and she suggested keeping it in for discussion regarding elevation. Dr. Foster asked whether this is expanded beyond this one program. Dr. Cassak said his understanding is that NSF wants to put in a 10-year moratorium for new science until they make it safe for people to be there. There was discussion about the nuclear fission-based power and propulsion technologies finding. Regarding the "no irreversible action," there was a suggestion to attach that language to the VIPER and rover findings. More items were presented for consideration: DAC meeting frequency, the desire to increase funding or rewards for education pieces of proposals, and the perception of the administration/OMB/Hill about climate change.

For climate change, there was discussion about the finding for the perception that climate change is not a priority at NASA. Dr. Hendrix recommended a compliment to NASA on their climate change plan and on hiring a chief scientist who is a climate change person and the Chief Climate Officer. There was agreement about the importance of having "climate change" in their title.

Dr. Godwin said, for community-level climate action plans and commissions, she would like to see connectivity down to the grassroots level. Dr. Tucker said there are activities that are doing that; as part of 'making data available' they picked 75 types of data sets from ES to make that data available to communities. That is part of what the EIC is supposed to do. There are a lot of projects to do this in the R&A; it is about 25% of the R&A budget in ES. There was discussion about the degree of opportunity and amount of information available to communities and the importance of making it available.

There was a discussion of the SW F&Rs. Dr. Hendrix recommended a finding about the number of challenges in the areas of science and measurements. Kudos to HPD were suggested for great work in the HP Big Year and all their outreach and for the good job they're doing in terms of cross-cutting of agencies. There was discussion of a recommendation about maintaining momentum in HPD after the Big Year. There was additional discussion about observatories and space monitors as a finding. Dr. Foster asked whether there is an effort to understand economic impact; she would like to encourage more partnerships to keep developing the economic assessments of damage from all these events. Dr. Tucker suggested telling SMD to get ES and SW to collaborate on the EIC. Maybe SW should be part of Earth Information. Dr. Cassak said the SWC did point out that there are a lot of similarities between ES and SW. Dr. Tucker said it could help the public understand the value of SW. There was more discussion about the recommendation.

Ms. Burkey led a discussion about NAC and DAC meeting frequencies, which included GPRAMA meetings.

There was discussion about other F&Rs, starting with extended planetary protections. There has been a standing request for more information about what is and isn't covered and who is responsible for it. To understand the gap, maybe short of a briefing, the committee could just make a recommendation. Dr. Hendrix said there used to be a Planetary Protection Advisory Committee and a Planetary Protection Subcommittee; and there is interest from the community to bring them back. Nathan Boll provided information about past requests and lists of topics and suggested including them in the findings from this meeting to convey to SMD what the committee would like to do and see at the next meeting. There was a discussion about topics for the next meeting: planetary protection, ISS transition, DSN update. There was discussion of HEC availability and accessibility, not just at the ESAC level but higher.

The committee reviewed the draft slides for the outbrief. Discussion topics included the trend in cancellations, potential need for better contingency plans, funding, and ways to match and balance budget provided by experts. Dr. Tucker said there needs to be a recognition that COVID-19 had a big impact and there needs to be care not to over-correct. There were suggestions offered about canceling missions and costing them properly. Dr. Holley-Bockelmann noted how tight the NASA budget is and how much is done with so little and the difficulty of figuring the cost ahead of time. She recommended decision rules or the recognition that canceling a mission has a profound impact. Dr. Ishii suggested making it a statement of concern. Dr. Foster suggested making it an observation and then requesting information at the next meeting.

Adjournment
The meeting adjourned at 5:42 p.m.

October 10, 2024

Call to Order/Summary of Agenda
Mr. Nathan Boll called the meeting to order and reviewed administrative announcements about meeting logistics, including FACA information. Dr. Hendrix welcomed everyone to Day 3 of the NAC SC meeting and reviewed the agenda for the day.

Public Lecture: OSIRIS-REx
Dr. David Smith, OSIRIS-REx Program Scientist, introduced Dr. Jason Dworkin, OSIRIS-REx Project Scientist at Goddard Space Flight Center. Dr. Dworkin thanked the committee and acknowledged the initial PI of OSIRIS-REx, Mike Drake, showing a video of his thoughts about 'why we are here' and giving an overview of the OSIRIS-REx documentary. He noted that the full-length feature documentary is on NASA+.

Dr. Dworkin reviewed the formation of a stellar system and the scale compared to a solar system. He said the way to understand the emergence of the early Earth is to look at the rocks; rocks have a memory. He reviewed the history of sample collection and the process on OSIRIS-REx. The spacecraft has an instrument deck with cameras and spectrometers, and a 3-meter long pogo-stick-shaped divide. He described the mechanism of collection, after which the sample is stowed in the sample return (SR) canister and brought back to Earth.

The spacecraft launched in 2016 with the aim to get a piece of an asteroid from the belt between Mars and Jupiter, which has various types of asteroids. Bennu is the target asteroid and is .5 km across, on the scale of a launch pad.

A year after launch the spacecraft was able to capture images of Hurricane Maria and Hurricane Jose. It maneuvered around the asteroid and earned two world records and broke one for the lowest orbit achieved. The 24-hour collaboration between the science and navigation teams had to be done in 4 hours to meet the targets for the navigation. After observation, a sample was collected from the surface of asteroid Bennu.

Dr. Dworkin described Bennu as a rubble pile. He then showed a video of collection and discussed the process. He noted that data said the surface would be smooth, sandy, and beach-like, but it was actually full of boulders. The spacecraft descended at 10CM/sec about a half meter into the surface and left a crater. Just over a year ago, the spacecraft came to Earth and ejected the SR capsule. Dr. Dworkin described the return of the sample capsule in Utah.

Over 200 scientists around the world are studying the sample now, including scientists from JAXA, the Canadian Space Agency, JSC, and more. NASA's objective is to help the engineers understand how to maximize the scientists and help the scientists understand the limitations of engineers. Dr. Dworkin reviewed the complicated sample analysis plan. The sample is dark and smells of sulfur, gunpowder, and burned marshmallows. It has two major lithologies.

Public Comments
Mr. Boll opened the meeting to the public for comments and questions. While the committee waited for comments, they continued discussion.

Dr. Foster thanked Dr. Dworkin for the OSIRIS-REx work and presentation. She asked whether there is more understanding about why all the projectiles are happening and the material is moving fluidly: what are the physics around how they are moving and how

asteroids are moving material? Dr. Dworkin said they had two major hypotheses for how this happens at the asteroid: 1) thermal cracking of the rocks as it goes through hot and cold cycles during rotation and 2) small impacts that eject particles. It's a wet sample but, relatively speaking, it's dry and builds up an electrostatic charge easily, so it jumps around under manipulation in the lab. There could be trapped gasses that would easily explode, so a small amount of force at this low gravity environment would release materials. The science team only has 2 years to investigate the sample. Dr. Foster asked whether solar wind could affect the samples; Dr. Dworkin replied that, as a non-organic chemist, he has no idea. Dr. Ishii noticed that up to 25% of the sample is available for distribution but 14% is planned at the current level. Dr. Dworkin affirmed that and said time is running out. He said there is an obligation to use the sample wisely and within the time. It's a national asset so there is a baseline plan, and it is on track for time. Things are slow, curation is a meticulous job, and the curators cannot be rushed. The desire is to avoid rushing, analyze what we need, and get the results.

Dr. Bagenal wondered whether they are part of the writing an extended mission proposal, a part of the extended mission process. She wondered whether it would be better to have people compete through the Solar System Workings (SSW) proposal system, independent of the mission, or whether the extended mission proposal is the most effective way to get the sample analyzed. Dr. Dworkin clarified that the extended mission is for the spacecraft, and that he follows the sample not the spacecraft; it's an opportunity for the next generation to have that experience. Regarding the funding of sample analysis by NASA, there are many ways to use NASA's money. They could be part of extending a large call or sample analysis call. Members of the team and members of the community can do great things with this material, and they are following the NASA and JSC sample preservation plan so plenty can be left for the future. A sample stored at -80C to preserve volatiles and prevent infusion of microbial growth from Earth will be opened in 50 years, so a whole new generation of people can look at it.

A public comment from John Whitehead, PhD, was sent via email, read aloud by Mr. Boll, and entered into the record. *Thanks for the terrific talk about OSIRIS-REx, and best wishes to Europa Clipper. Here are my comments on another topic. Considering that the Ingenuity Mars helicopter was publicized as a risky tech demo despite much flight testing under Mars-like conditions, we need more conversation about flight testing the mission-critical rocket that will launch samples from Mars to orbit, the Mars Ascent Vehicle (MAV). The MAV needs to be so capable that it could reach a thousand miles when flown over Earth, farther than existing small rockets. Regardless of the technical approach and design details, the MAV will be at least somewhat new and original, worthy of multiple launches over Earth to ensure successful Mars Sample Return. The following links from the Tenth International Conference on Mars (July 2024) describe an approach to MAV testing, and explain why the MAV is a miniature launch vehicle, not just another spacecraft. https://www.hou.usra.edu/meetings/tenthmars2024/eposter/3381.pdf https://www.hou.usra.edu/meetings/tenthmars2024/pdf/3381.pdf. The MAV challenge has been misunderstood and underestimated for decades. See also my 2007 comments published in Nature (Vol 449 p972, 2007Oct25) which included, "it's impossible to tell whether a Mars sample return mission will work without actually building and testing miniature launch vehicle technology." https://www.nature.com/articles/449972c https://rdcu.be/dGjgm (PDF).*

A public comment from John Whitehead, PhD, was sent via email and entered into the record. *Another comment for Mars Sample Return. All other space science missions including planetary science have been very lucky that their propulsive maneuvers have been within the realm of proven technology used for Earth satellites. As a result, the community*

has automatically believed that mere design studies will lead to building a Mars Ascent Vehicle on budget and on schedule. This assumption is inherent to the currently ongoing "Rapid Mission Design Studies" for Mars Sample Return. Some of the comments for rejected proposals show that the proposal reviewers for this project did not even understand that a miniature launch vehicle is a new thing that needs creative engineering. All this was explained in 2020, in my three white papers submitted to the Planetary Decadal Survey. The final document, Origins, Worlds, and Life, did not mention the MAV challenge. The Technology chapter in the Decadal document said we need to improve propulsion technology for all other kinds of maneuvers, but made no mention of launching off planets. This year (2024), I asked about this in talking with one of the co-chairs of the Decadal Survey, and the reply was that the omission in the Technology chapter was probably an oversight.

Dr. Foster asked how the samples are being archived. Dr. Dworkin said the samples were put under nitrogen within a little over an hour after SR. There are in an ISO-5 clean room with a nitrogen purged glove box and, then, inside containers to help minimize volatile loss over time, as well as a dedicated hermetic seal sample, to prevent volatile loss but can be opened repeatedly. They are considered curation pristine while in the nitrogen environment. When returned, samples will be stored in a different container to maintain their integrity. Dr. Dworkin confirmed that this was all at 1 atmosphere pressure, a slight over pressure. As the sample was returned under atmospheric, the canister had an air filter which was designed to repressurize through descent, the air filter kept out water vapor, organic compounds, and particles. This was a New Frontiers 3 mission and PI-led with a cost cap, so to return a sample under hermetic seal would mean either a smaller sample canister, which was chosen, or a larger sample canister which was above the cost cap.

Mr. Espahbodi asked, based on observations and achievements in this effort, what would you like to see the next generation pursue? Dr. Dworkin said he'd like to see more organic chemistry and science about our origins. The Decadal lays out several exciting missions: SR from a comet, from a series. Dr. Dworkin would love to see a Europa submarine. The solar system is filled with places to look at to understand our place and put exoplanets in context. He said understanding other planets helps us understand the origin of our Solar System, how others are formed, and habitability. As a lab person, Dr. Dworkin is most interested in samples from the lunar South Pole, MSR, etc.

Out-brief to NASA SMD

Sandra Connelly, SMD Deputy Associate Administrator, and Doug Hudgins, SMD Assistant Deputy Associate Administrator for Research (Acting), joined the meeting for the outbrief.

Dr. Hendrix reviewed the SMD Update. She touched on topics that came up during the meeting upon which there may be F&Rs, including topics they'd like to learn more about in the future. She provided an overview of the meeting's agenda. And she gave kudos to the use of NASA data as they are integrated into hazard/disaster mitigation programs/efforts. In a future SC meeting, the SC would welcome a discussion from the AA on agenda topics and thoughts on how the SC can support SMD in the areas covered on the agenda and elsewhere. Dr. Hendrix noted that there are strong inconsistencies in the way the DACs are operating and, particularly, in frequency of meetings.

Regarding the IDEA Initiatives Panel, Dr. Hendrix gave kudos to SMD for useful R&A Program Yearbooks. She reviewed potential topics of F&Rs; Ms. Connelly said every leader has IDEA criteria in their performance plan, so all are responsible for ensuring robustly integrated, diverse teams that are helping to advance science. There is also a contract team on-site and an employee resource-led team supported by that contract service leading IDEA

activities from a grassroots perspective. Ms. Connelly expressed interest in knowing more about harassment because there have been concerted efforts and a belief that things were getting better. Ms. Connelly said the committee may not be aware of the number of activities the SMD is doing in this area. There was a brief discussion with Dr. Bagenal about undergraduate research projects and the inclusion of undergraduates in proposals.

Topics for future meetings were reviewed, including a look forward to the SMD response to the two NASEM reports. Dr. Hendrix reviewed items and future topics for the Open Science Initiatives Panel. Next, she reviewed the potential F&Rs from the Climate Change Panel. Ms. Connelly understood all of these and said SMD can follow up at the next meeting. She added that, in SC findings to SMD, it might be helpful to understand the basis of the perceptions, i.e., what is leading to this perception. Dr. Hendrix reviewed the Space Weather Panel discussion. She gave kudos to Heliophysics for the Heliophysics Big Year and cross-cutting work across agencies. She reviewed potential F&Rs, including increasing awareness and understanding within the general public. Ms. Connelly noted that there are other government agencies that are responsible for understanding the impacts, together with industry.

For R&A, Dr. Hendrix reviewed the potential F&Rs and said SC would like to hear more about selection rates and funding of programs in each division. She highlighted the FINESST program, and the significant fraction of the community not being reached and said there may be significant barriers to access. A future topic may be to have each DAC present each Division's budget, including percentage of budget dedicated to R&A. Dr. Hendrix reviewed the prior finding for VIPER's cancelation and additional potential F&Rs for VIPER. There is concern for VIPER and irreversible action taken before the science community can weigh in formally. The committee would like an update on VIPER – maybe from Jim Free – to understand the forward strategy. Ms. Connelly said Dr. Fox would probably provide that. She believes there have been a couple levels of response to the letter from Congress. Ms. Connelly suggested keeping the finite budget in mind for recommendations. Regarding mission budgets, cancellations, and extensions, Dr. Hendrix reviewed the potential F&Rs and topics for the next meeting. The community would like to have more transparency and understanding of the process – for example, do they get independent evaluations, throughout a mission lifetime, of technical readiness and cost and schedule? How does SMD balance cost overruns on missions of different scales, versus R&A budgets, and is this something the committee or the NAC or DACs can weigh in on? Ms. Connelly said there is a lot of information that can be provided on this; the simple answer is there are independent reviews throughout the development cycle and senior review process provides independent review of operating missions, but that can be expanded. Regarding ISS, Dr. Hendrix talked about it as a worldwide asset that is critical for space and science research, in particular BPS relies on a space station platform. The transition to commercial stations is a source of concern for the community, including gaps in science and international diplomacy effects. She said SC would like a briefing at the next meeting. Ms. Connelly agreed, it is a big transition, and we want to make sure the science continues.

Next, Dr. Hendrix reviewed other potential F&Rs. Ms. Connelly said it would be helpful to hear more detail so SMD can be responsive. Finally, topics for the next SC meeting were reviewed. Ms. Connelly appreciated the summary level information here; she said some of these will be helped by a deeper level of detail.

Dr. Bakhtian congratulated Ms. Connelly on her work at NASA, upon her retirement. Ms. Connelly expressed appreciation for the committee's work and disappointment that they could not be together for the Clipper launch. Dr. Hendrix closed the meeting with thanks to everyone and "Go Clipper!"

Dr. Bagenal asked to go back to the issue of budget. She wondered whether there are valuable lessons to be learned or shared on the issues of cost overruns. There seem to be a lot of them, Psyche, Dragonfly, Europa Clipper, VIPER, GDC, seems to be a lot of cost overruns and technical issues. All of these things have had reports on lessons learned, evaluations, etc.; has the pulling together of those happened in terms of thinking about the larger view at the SMD level? Ms. Connelly said, yes, lessons learned are shared; on Psyche it was shared agency-wide. She thinks part of why we're seeing some of the overruns right now tie into the supply chain issues from COVID-19, but managing performance effectively is a constant focus. She said there is recognition that we are working in a higher risk realm and a lot of time is spent to reduce risk, so there is a whole spectrum, and performance is a key focus area, we try to make sure we apply lessons learned across Directorates. It is a constant cycle; when you fix one mistake, perhaps you uncover another. There is a strong culture of continuous learning and improvement. Dr. Bagenal suggested that SC think about whether it makes sense to convene a panel to explore this topic further.

Dr. Hendrix thanked Ms. Connelly and all the committee members for the input during the meeting. She thanked the public for joining and Ms. Burkey and Mr. Boll for their support. The committee will be in touch with F&Rs and feedback from the community is welcome. Ms. Connelly thanked everyone again and said SMD looks forward to the F&Rs.

Adjournment
The meeting adjourned at 5:30 p.m.

Findings & Recommendations from Previous Meetings

Feedback for NAC Executive Director

- NASA should prioritize regular scheduling of NAC meetings, with meeting dates established well in advance, to ensure that the work of Committees, Sub-committees, and Task Forces are presented in a timely fashion.
    - (NAC will aim to hold 3 meetings/year, beginning in 2025)

SC – Science Mission Directorate (2023)

SMD should provide input to future NAC SC meetings that includes:

- SMD philosophy on balance of innovation and risk(e.g., SMD CLPS missions)
- The status of preserving the integrity of planetary bodies under international exploration and possible future commercial development.
- Update on the SMD climate change research study (e.g., what missions/programs are in place and under planning)
- Planning based on the release of the BPS Decadal Survey
- Update on detection and warning capabilities for Space Weather events.

Division Advisory Committees (DAC) Reports – Spring Meeting 2023

- While respecting the diversity of the SMD Divisions in their approaches to inclusivity, SMD should identity, standardize and disseminate core best practices that all can use to prevent/minimize duplication of effort.

DAC Reports – Summer Meeting 2023

- SMD should provide input to future NAC SC meetings on the purpose and philosophy of the SMD advisory committee structure, execution of committee meetings and potential standardization across the divisions.

DAC Reports – Spring Meeting 2024

- SMD should establish guidelines for knowledge sharing and transparency between SMD divisions and their DACs, including participant of the DACs in proposing agenda topics, and regular meeting frequency.

SC - Science Mission Directorate (2024)

- SMD should present budgetary information in the main presentation to the SC, including comparisons with recent previous budgets, requested budget and notional outyears budgets.
- SMD should improve communication with the SC and stakeholder committee by addressing the factors considered in implementing the budget including:
    - o Clarify what tradeoffs were made, and how the consequences were assessed in line with SMD strategy, and risks/mitigations.
    - o Clarify the procedures to be used in pending decisions, such as the change from mini-Senior Review to operational paradigm review for Chandra and HST.
    - o Clarify how scientific goals will remain a pillar of SMD participation in the Artemis Program
    - o Develop guidelines for addressing budgetary issues that create conflict with Decadal Survey priorities, such as cancellation of the Geospace Dynamics Constellation (GDC) mission, which is a flagship mission in the existing Heliophysics Decadal Survey.

IDEA at SMD (2023)

- SMD should develop a centralized repository and identified POCs to capture consolidated LTB best practices and share with others.

IDEA at SMD (2023)
- SMD should expand the impact of the Lower the Boundaries (LTB) initiatives by developing an overarching set of principles, top-level strategies, lessons learned, best practices, incorporating previously successfully-tested efforts.
- SMD should continue to build on the capabilities of the EIC, including full development of the Science Discovery Engine.

Transform to Open Science Program (2023)
- SMD should provide clear documentation and examples for the use of standard packages such as ORCID, Zenodo and GitHub for open-source data and software.
- The Open Science 101 course design should expand or add a module on the benefits and coordination of TOPS/IDEA practices.
- The prioritization criteria for migrating information to the cloud and quickly making information broadly available should include environmental social justice.

Broadening SMD Science Impact (2024)
- SMD should develop clarification on how proposal requirements for DEI, OS and OSS will be fairly matched to budgetary resources available.
- SMD should develop clarification of how researchers with primary responsibilities for data or source code production can be recognized and rewarded.
- NASA should provide guidance to universities and project teams in states with policies limiting DEI activities on how effective DEI activities can be legally supported.

Science and HEO Committees
Deep Space Network (2023)
Recommend that SMD*:
- Increase internal resources to evaluate DSN needs and approaches, and to provide input to SCaN and NAC.
- Evaluate short-term options to improve the efficiency of the present DSN, such as the GSFC/JPL and other labs/ activities on

Delay/Disruption Tolerant Networks.
- Inform and consult the science community about the available communications capabilities.
- Evaluate the availability of interagency capabilities and potential commercial capabilities, inc. pros and cons.
- Begin addressing deferred maintenance of DSN.
- Develop a sustainable, systems-level DSN management model with immediate plans for increased annual funding.

Considerations should include technical aspects, business plan (e.g., user facility tax, contributions beyond US government),
and system-level awareness (e.g., multi-national potential, issues with SmallSats).
- Inform and consult the National Space Council on the issues with the DSN and their resolution.
- Champion addressing the possibility of the DSN becoming part of a public-private, multi-stakeholder, sustainable, collaborative Solar System Internet as part of the Future DSN study.

Deep Space Network (2024)
- Communicate how it is planning to maintain sufficient deep space communications capability for its missions planned for the next decade.

SOMD
Recommend that SOMD*
- Address the shortfall in NASA Deep Space Communications Network by:
- Detailing and emphasizing the requirements for expansion and sustainment of the Deep Space Network (DSN);
- Completing plans for, and funding the expansion of, the capability of the DSN.

*NOTE: this should be done in recognition of the National Academies recent study titled "NASA at a Crossroads."

NAC TI&E and HEO Committee - Technology Infusion into the Moon to Mars Program
NASA should clearly identify infusion path for technologies currently in development by STMD into the Moon and Mars Program architecture. Identify Lunar Surface capabilities, in particular In-Situ Resource Utilization (ISRU) capabilities within the lunar segments of the architecture. Conduct an architecture concept review focused on long term lunar presence and sustainability.

Human Exploration and Operations Committee
NAC ESDMD
- The Committee embraces the Moon to Mars effort as a best practice that will serve the program well as it allocates available funds into prioritized programs and projects and recommends the Architecture Definition Document serve as a consistent guidepost for development of "Shall Statements" for follow-on contracted activity with industry partners.
- Conduct a Lunar Lander Services schedule and risk assessment.
- Lunar Lander Services suppliers should provide detailed schedule plans to NASA and complete risk assessment to NASA.
- Discuss: Does NASA have the ability to ask/require this of suppliers? In other words, is the agency in a position to be responsive to this recommendation?

STEM Engagement
Prior
- Committee recommends NASA catalyze additional efforts by the mission directorates to more directly support MUREP, such as co-funding the institutions in addition to the OSTEM funding. The MSI's are research sites making meaningful contributions to NASA's science and engineering knowledge and practice.
- Committee recommends NASA serve as a "broker" to develop a more in-depth understanding of MSI's grants by supporting a structured networked community. MSI's should be encouraged to leverage core competencies to grow the expertise across the MSI funding landscape. MSI's should assess, with NASA facilitation, institutional core competencies, opportunities to improve cross institutional team efforts and thereby increase impact of NASA funding opportunities.
- NASA should continue to furnish representation of diverse role models to ensure visibility, connection, and reflection of a diverse workforce that is essential for the future given the increasing global competition.
- Committee recommends NASA develop creative ways to engage under-represented communities attending educational institutions, in addition to the MSI community, at the undergraduate, graduate, high school levels.

New
- The Committee recommends that the NASA Administrator grow the important cross Directorate STEM efforts via leveraging the NASA STEM Gateway, and close coordination

among the Office of Communication and others. Clear success is demonstrated with the Aeronautics Mission Directorate, Space Operations Mission Directorate and Science Mission Directorate. Increased educational impact will result from additional coordination among OSTEM, Office of Communications and the Mission Directorates.

- The Committee recommends that the NASA Administrator develop methods and opportunities for assistance from external sources to improve impact for the under-served, economically disadvantaged, and under-represented communities. This is essential to enhance the STEM workforce necessary for the growing and evolving global competition using the expansive NASA capabilities and recognition.

Appendix A
Agenda

NASA ADVISORY COUNCIL
Science Committee Meeting
Remote Access Only
October 8-10, 2024

Public Agenda

DAY 1: Tuesday, October 8, 2024 (Eastern Time)

10:30 **Call to Order/Summary of Agenda**
Nathan Boll, Executive Secretary, NAC Science Committee

10:35 **Introduction of Members**
Amanda Hendrix, Chair, NAC Science Committee

10:40 **NAC Meeting Reports**
Amanda Hendrix, Chair, NAC Science Committee
Noel Bakhtian, Vice Chair, NAC Science Committee

11:00 **NASA Science Mission Directorate Update**
Nicola Fox, Associate Administrator, NASA Science Mission Directorate

12:00 *Break for Lunch*

1:00 **Panel Discussion: NASA IDEA Initiatives and SMD Updates**
Elaine Ho, Associate Administrator, Office of Diversity and Equal Opportunity, NASA
Michael New, Deputy Associate Administrator for Research, NASA SMD

2:15 *Break*

2:30 **Panel Discussion: SMD Open Science Initiatives Update**
Kevin Murphy, Chief Science Data Officer, NASA SMD
Chelle Gentemann, Open Science Program Scientist, NASA SMD

3:45 *Break*

4:00 **Committee Discussion**

5:30 *Adjourn*

DAY 2: Wednesday, October 9, 2024 (Eastern Time)

10:15 Call to Order/Summary of Agenda
Nathan Boll, Executive Secretary, NAC Science Committee

10:20 Division Advisory Committee (DAC) Chair Reports
Kelly Holley-Bockelman, Chair, Astrophysics Advisory Committee (APAC)
Jamie Foster, Chair, Biological and Physical Sciences Advisory Committee (BPAC)
Sara Tucker, Chair, Earth Science Advisory Committee (ESAC)
Paul Cassak, Chair, Heliophysics Advisory Committee (HPAC)
Hope Ishii, Chair, Planetary Science Advisory Committee (PAC)

12:00 Break for Lunch

1:00 Panel Discussion: Climate Change and Earth System Science Strategy
Kate Calvin, Chief Scientist and Senior Climate Advisor, NASA
Karen St. Germain, Earth Science Division Director, NASA SMD

2:15 Break

2:30 Panel Discussion: Space Weather Hazard Mitigation and SMD Roles
Joe Westlake, Heliophysics Division Director, NASA SMD
Jamie Favors, HPD Space Weather Program Director, NASA SMD

3:45 Break

4:00 Committee Discussion

5:30 Adjourn

DAY 3: Thursday, October 10, 2024 (Eastern Time)

10:15 Call to Order/Summary of Agenda
Nathan Boll, Executive Secretary, NAC Science Committee

10:20 Public Lecture: OSIRIS-REx
Jason Dworkin, OSIRIS-REx Project Scientist, Goddard Space Flight Center
Introduction by David Smith, OSIRIS-REx Program Scientist, NASA Headquarters

10:50 Public Comment Period

11:00 Outbrief to SMD

11:30 Adjourn

Appendix B
Committee Membership

Dr. Amanda Hendrix, Planetary Science Institute, *Chair*
Mr. Nathan Boll, NASA, *Executive Secretary*
Dr. Noël Bakhtian, Bezos Earth Fund
Dr. Fran Bagenal, University of Colorado Boulder
Dr. Paul Cassak, West Virginia University
Mr. Van Espahbodi, Generational Partners
Dr. Jamie Foster, University of Florida
Dr. Linda Godwin, University of Missouri
Mr. Edward Gonzales, Catholic University
Dr. Kelly Holley-Bockelmann, Vanderbilt University
Dr. Hope Ishii, University of Hawaii
Mr. Tom Soderstrom, Amazon Web Services
Dr. Sara Tucker, BAE Systems

Appendix C
Attendees

NAC Science Committee Members
Dr. Amanda Hendrix, Planetary Science Institute, *Chair*
Mr. Nathan Boll, NASA, *Executive Secretary*
Dr. Noël Bakhtian, Bezos Earth Fund
Dr. Fran Bagenal, University of Colorado Boulder
Dr. Paul Cassak, West Virginia University
Mr. Van Espahbodi, Generational Partners
Dr. Jamie Foster, University of Florida
Dr. Linda Godwin, University of Missouri
Mr. Edward Gonzales, Catholic University
Dr. Kelly Holley-Bockelmann, Vanderbilt University
Dr. Hope Ishii, University of Hawaii
Dr. Sara Tucker, BAE Systems

Webex Attendees

Waleed Abdalati
Max Bernstein
Adrian Brown
Joy Burkey
Chris Caisse
Kate Calvin
Lin Chambers
Stephen Clark
Anthony Colaprete
Sandra Connelly
Steven Crawford
Antonino Cucchiara
Rebekah Dawson-Rigas
Laura Delgado Lopez
Gina DiBraccio
Tammy Dickinson
Jeanette Edelstein
Sylvie Espinasse
Elizabeth Ann Esther
Mike Fanelli
James Favors
Jens Feeley
Dennis Feerick
Karen Flynn
Robin Ford
Jamie Foster
Jeff Foust
Nicola Fox
Nikky Garaga
Chelle Gentemann
Stephanie Getty
Kendrick Glenn
Hans Hansen
Janine Harris
Micheal Harrison
Brian Harvey
Hashima Hasan
Paul Hertz
Masatoshi Hirabayashi
Elaine Ho
Jeffery Hollingsworth
Douglas Hudgins
Andrea Hughes
Douglas Isbell
Heidi Jensen
Renee Jones
Jennifer Kearns
Jack Kiraly
Kelsie Krafton
Lisa Lacroix
Rob Landis
Gregory Lee
James Lochner
Kathy Mandt
Gene Mikulka
David Millman
David Morris
Kevin Murphy
Malayna Nesbitt
Michael New
Jeff O'Neil
Rachel Paseka
Matthew Pearce
Corey Portalatin-berrien
Griffin Reinecke
Luc Riesbeck
Julie Robinson
Richard Rogers
John Rummel
Charlie Scales
Abigail Sheffer
Kartik Sheth
Margaret Simon
Marcia Smith
Karen St. Germain
Vanessa Thomas
Grant Tremblay
David Urban
E Vandad
Paul Voosen
Zoe Wai
Johnathan Watts
Shoshana Weider
John Whitehead
Michael Wiltberger
Crystal Wood
Tim Zimmerlin

Appendix D
Presentations

1) NAC Meeting Reports [Hendrix, Bakhtian]
2) NASA Science Mission Directorate (SMD) Update [Fox]
3) NASA IDEA Initiatives and SMD Updates [Ho, New]
4) SMD Open Science Initiatives Update [Murphy, Gentemann]
5) Division Advisory Committee (DAC) Chair Reports [Holley-Bockelmann, Foster, Tucker, Cassak, Ishii]
6) Climate Change and Earth Systems Science Strategy [Calvin, St. Germain]
7) Space Weather Hazard Mitigation and SMD Roles [Westlake, Favors]
8) OSIRIS-REx [Dworkin, Smith]