


NASA ADVISORY COUNCIL

SCIENCE COMMITTEE

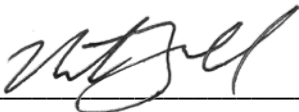
March 25, 2024

Virtual Meeting

MEETING REPORT



Ellen Williams, Chair



Nathan Boll, Designated Federal Officer

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Monday, March 25, 2024

Call to Order

Mr. Nathan Boll, Designated Federal Officer (DFO) for the NASA Advisory Council (NAC) Science Committee (SC), opened this virtual meeting by greeting the participants. He then reviewed the Federal Advisory Committee Act (FACA) rules. Under FACA, the meeting was open to the public and minutes were being taken to be posted on the NASA website. All presentations and statements would be part of the public record. Each SC member has been appointed by the NASA Administrator on the basis of his or her subject matter expertise. The members are subject to Federal ethics laws. As such, members must recuse themselves in the event of a personal or institutional conflict of interest (COI), including financial. Members with questions or concerns about possible COIs should discuss the matter with Mr. Boll.

Mr. Boll next introduced Dr. Ellen Williams, Chair of the SC.

Introduction of Members/Summary of Agenda

Dr. Williams welcomed those attending and had the members introduce themselves. She recognized the contributions of four members who were no longer on the Committee, along with the former Executive Secretary. The SC held meetings in May and August of 2023, but because the NAC has not had any meetings since January 2023, the findings and recommendations (F&Rs) from those meetings are still pending. There is likely to be a NAC meeting in May, at which time the F&Rs will be reviewed. This review is necessary in order for the F&Rs to work their way through the system, ultimately arriving at the Science Mission Directorate (SMD).

Dr. Williams reviewed the agenda for this SC meeting. There was some flexibility, but the public comment session had to adhere to the schedule. She then introduced Dr. Nicola Fox, Associate Administrator (AA) of SMD.

SMD Update and Budget Presentation

Dr. Fox noted that Dr. Williams was presiding over her last meeting as SC Chair, and thanked her for her work and time over the years.

Next, Dr. Fox presented a graphic of the more than 140 science missions NASA has in operation and development. The Fiscal Year 2025 (FY25) President's Budget Request (PBR) has been released. In order to be clear and transparent, SMD held a budget town hall to get information out to the science community. Sen. Bill Nelson, the NASA Administrator, emphasized the value of NASA science, as did other NASA AAs. NASA science projects are investments in the future of NASA and are interconnected. All discoveries and innovations build on one another. SMD work touches everyone on Earth. At the budget town hall, Sen. Nelson discussed the FY25 fiscal climate, which is constrained and a challenge for SMD. NASA wants to do more science but the resources are limited. Nonetheless, Dr. Fox expects the science community to continue doing great work. Congress will deliberate on the PBR.

A graphic of the SMD science divisions illustrated how they are cross-cutting and collaborative, with strong integration and creativity. The FY25 PBR has a balanced portfolio falling under four priority areas: Exploration and Scientific Discovery; Innovation; Interconnectivity and Partnerships; and, Inspiration. Dr. Fox discussed how the FY25 PBR addresses each of these.

In the area of Exploration and Scientific Discovery, SMD will be balancing strong legacy operating missions while also investing in new technologies and missions. NASA will restart the Venus Emissivity, Radio Science, InSAR, Topography, and Spectroscopy (VERITAS) mission in the Planetary Science Division (PSD). Each division has science under the Artemis program; Dr. Fox made special note of

projects from the Biological and Physical Sciences (BPS) Division, along with lunar work and space weather efforts. The Exploration and Scientific Discovery area also supports fundamental research.

Under Innovation, Dr. Fox spoke of Mars technology development, a space-borne gravity gradiometer, and novel magnetometers. The Habitable Worlds Observatory (HWO) technology maturation project will lead to the first telescope designed specifically to search for life elsewhere. The BPS-supported Commercially Enabled Rapid Space Science (CERISS) effort will develop new research capabilities to enable faster discoveries. In the Interconnectivity and Partnerships area, Dr. Fox mentioned key international, industry, and interagency partnerships. Finally, the Inspiration area includes the Bridge Program, which will help underserved communities take advantage of NASA science opportunities. At the same time, the Open Source Science (OSS) effort will accelerate scientific discovery.

Although the science fleet remains strong and balanced, the FY25 SMD PBR includes some major changes. The Mars Sample Return (MSR) mission architecture is still under review, though it is expected to roll out soon. Once that is finalized, other PSD missions may be affected. The SMD budget does support the Dragonfly mission, which will launch in 2028 to explore Titan, one of Saturn's moons. In the Earth Science Division (ESD), an implementation approach called Decouple, Partner, and Compete (DPC) will be applied to the Earth System Observatory (ESO), including the Atmosphere Observing System (AOS) and surface biology and geology missions. Finally, the Heliophysics Division (HPD) Geospace Dynamics Constellation (GDC) mission had been paused but is now canceled due to outyear budget constraints.

Dr. Fox reviewed budget highlights by division, starting with ESD. The DPC approach will reduce costs and optimize the scope of new efforts. As part of this, the AOS architecture will be restructured. While it still includes high-priority measurements and multiple missions, it will now have a mix of directed and competed missions, with decoupled schedules. This should provide more flexibility. The DPC approach will also apply to the Precipitation Measurement Mission (PMM) being done in partnership with the Japanese Space Agency (JAXA), as well as the aforementioned geology and biology missions. The Surface Deformation and Change (SDC) study has been discontinued. Also in ESD, the Landsat Next mission is moving into procurement, while the Division hopes to have better pacing for Explorer and Venture-class proposals. In addition, the Terra/Aqua/Aura mission has been extended, support remains for R&A, the Responsive Science Initiatives Program will encourage collaborations, the Interagency Satellite Observation Needs program received a budget increase, funding for Geodesy infrastructure doubled, and there is support to begin Quantum Gravity Gradiometer (QGG) development.

In BPS, the budget funds CERISS, optimizes partnerships, aligns with high-profile initiatives, supports science that responds to Decadal Survey (DS) recommendations, and sustains ongoing efforts such as OSS and Inclusion, Diversity, Equity, and Accessibility (IDEA).

Although there is much focus on the cancellation of GDC, there are multiple HPD missions in operation and development, including seven that are set to launch in 2025-26. The Division also maintains a healthy Explorer cadence and is engaged in international partnerships. Dr. Fox repeated that the GDC cancellation is largely a factor of outyear budget constraints. The GDC team has 180 days in which to provide Congress with a study on what it would take to deliver GDC science by the end of the decade. Space Weather funding remains strong and includes the Centers of Excellence (COEs) and a multi-agency effort in Research-to-Operations-to-Research (R2O2R). The budget also supports sounding rockets, orbital debris demonstrations, and the Diversify, Realize, Integrate, Venture, Educate (DRIVE) science centers. Following the 2023 Senior Review (SR) recommendations, the budget maintains the fleet of extended missions in HPD.

PSD is awaiting the results of a budget and architecture study before the FY25 budget for MSR can be finalized. That should occur soon. Otherwise, the budget supports the launch of the Europa Clipper and the Near Earth Object (NEO) Surveyor, several missions to study Venus, the Mars Exploration Program, and a robust Lunar Discovery and Exploration Program. Some calls for proposals have been delayed, as have some pre-formulation studies recommended by the most recent Planetary DS. There is funding for the new Planetary Technology projects, investments in OSS and the transition to cloud computing, support for Radioisotope Power Systems, and funding to expand the Planetary Data System data archives.

Finally, the Astrophysics Division (APD) will have support for the 2027 launch of the Nancy Grace Roman Space Telescope (Roman), HWO technology maturation, the first astrophysics probes, and a healthy cadence of Explorer missions. A planned mini-SR for the Chandra and the Hubble Space Telescope (HST) has been supplanted by an Operations Paradigm Change Review (OPCR), which will seek community guidance for options on future science operations. The budget funds ongoing operation of the James Webb Space Telescope (JWST), extended missions, the balloon program, R&A efforts, technology investments, and partnerships. The Stratospheric Observatory for Infrared Astronomy (SOFIA) will continue its shutdown with parts disposition. A merged image showed how JWST and HST complement each other and lead to greater understanding of the universe.

NASA science will do great things despite these challenges. A solar eclipse is imminent and provides an opportunity for all five science divisions to discuss what NASA does.

Committee/AA Q&A

Dr. Williams began the discussion period. She noticed that when Dr. Fox talked about APD there was mention of healthy R&A selection rates and workforce development. She wondered how these are assessed. Dr. Fox said that R&A is a very high priority and SMD constantly analyzes selection rates, who is funded, the success of the Dual Anonymous Peer Review (DAPR) program, and support for early career (EC) scientists. Dr. Noel Bakhtian asked for a comparison to the FY24 budget, a further explanation of DPC, and which ESD highlights were related to climate. Dr. Fox said that she would come back with the budget information. The DPC concept originated in ESD to allow for more budget flexibility and less-tightly aligned schedules. All of ESD supports climate research.

Dr. Jamie Foster asked what was going on with the Deep Space Network (DSN) and how it is balanced. Dr. Fox replied that the NASA Space Communications and Navigation (SCaN) program has a new head. SMD works closely with SCaN for science support. There are plans for moving to some commercial solutions and she hoped to be able to provide an update at the next SC meeting. Regarding the MSR budget, that should be solidified soon.

Dr. Paul Cassak explained that the heliophysics community has had a lot of uncertainty and many questions about the GDC. He asked for confirmation that the cancellation reflects the outyears. Dr. Fox replied that it is indeed a result of the lack of budget going forward. There was no funding to realize the mission, and keeping people paused for so long is unfair. The HPD team will develop a report on how to obtain some of these measurements with and without the GDC by the end of the decade. NASA wants community input on the best way to move ahead. The Dynamic mission concept relies on GDC, creating uncertainty there as well.

Dr. Sara Tucker observed that the HPD budget increases funding for cubesats. She pointed out that the SC had previously expressed concerns about the level of DSN resources going to cubesats. Her question was about ESD and the idea that part of the AOS mission may be competed. The community originally thought there might be three Earth System Explorers (ESEs). They are still waiting to hear back on the first two. If the third is replaced by an AOS, is that an actual replacement or something that may be

emphasized as a competed AOS component versus an independent ESE? Dr. Fox said she would get back to her.

Dr. Kelly Holley-Bockelmann also stated that the SC is concerned with space communications. Roman will have enormous space communications needs; the astrophysics community is worried that NASA's response is insufficient and a bit late. APD must address Time Domain and MultiMessenger (TDAMM) astrophysics, which sometimes requires flexible observations and a giant, quick pivot. The Astrophysics Advisory Committee (APAC) has been very concerned about ScaN. Committee members are becoming proponents of optical communications, which will percolate up. APAC is also concerned about the OPCR for HST and Chandra. Dr. Fox said that APAC is right to be concerned about communications. Everyone wants to bring back what they can from these great missions. She also agreed with the point about TDAMM and communications. Dr. Holley-Bockelmann replied that this seems like a bigger problem than SMD or even NASA. Dr. Fox said that this will become part of the budget request. There is work being done and the requirements are understood. The comments and findings are important.

Referencing the chart with the mission fleet, Dr. Linda Godwin said that DSN is her top concern as well. When she looks at the chart, she sees the data becoming the main problem. It was not clear that the SC recommendations will be passed up in time for action and she wondered if there were alternatives. Dr. Williams agreed with the need to push this forward. Mr. Boll explained that the process is that the F&Rs go to the NAC, which approves them. They next go to the NASA Administrator, who passes them to SMD. The SC cannot control the NAC meetings. Dr. Williams suggested that she might complain informally, since she was leaving the SC. Mr. Boll said he would talk to her off-line. He added that despite the debriefing, the SMD AA cannot act on F&Rs until they are formally delivered.

Dr. Fox pulled up the budget charts. The SMD appropriation for FY23 was \$7.791 billion, the PBR for FY24 was \$8.3 billion, the enacted FY24 budget is \$7.3 billion, and the FY25 PBR is \$7.565 billion. The charts broke out the funding for each science division. Dr. Cassak noticed some fluctuations in the out-years. Some missions ramp up and down, but he wanted to know if there was anything else. Dr. Fox said that the first chart was for ESD and PSD. ESD Explorers are ramping up, and the biggest change is MSR, which is being developed and will result in an adjustment. Dr. Fox called up the HPD and APD chart. The HPD fluctuations come from the GDC cancellation and some operating costs, not R&A. The 2025 launch of the Interstellar Mapping and Acceleration Probe (IMAP) will result in a further decrease.

Mr. Boll thanked Dr. Fox. The meeting broke for lunch.

Division Advisory Committee (DAC) Chair Reports

Following the break, Mr. Boll asked for the presentations from the Division Advisory Committee (DAC) chairs, starting with APAC.

APAC

Dr. Holley-Bockelman reported that APAC met the previous week. She showed the agenda, then listed the meeting themes:

- Chandra and HST in danger;
- Aging communications infrastructure;
- Re-envisioning the Explorer program;
- A new open software paradigm; and,
- TDAMM.

These are troubling times but there are still great missions being launched. She showed a graphic of the astrophysics fleet, observing that it is perhaps ironic that part of the overall problem could be that older

missions are still doing extraordinary science. HST and Chandra are vastly oversubscribed, for example. This leads to the concern about the OPCR effort to streamline the budgets for those two missions. The options for this review are maintaining the status quo, restructuring the projects, or termination. APAC was surprised that termination is even being considered since the oversubscription rate is quite high, the community relies on them heavily, and little if any of the science can be done from the ground.

APAC meetings use a dashboard function for public comments, allowing members of the public to vote on which comments and questions are most important. A comment about the importance of Chandra science received an unprecedented 464 votes, and a similar comment about HST received 404 votes. Together, the comments note that budget decreases to the two missions have already cut into operations, guest investigator grants, and more. The community is worried about the impact of further cuts. In addition, while HST has strong Congressional support, Chandra is not quite as popular on Capitol Hill despite being the only x-ray telescope with its particular scientific capabilities. The comments acknowledge that the budget challenges are real, but these missions are exceeding what was envisioned when they were developed.

Adding onto this, APAC is concerned that the OPCR process is happening out of the public or APAC view. Astrophysics SRs typically report to APAC, which has now been removed from the process.

At its October meeting, APAC had a presentation from Dr. Jeffrey Hayes, who is now with SCaN after many years in SMD. Following the presentation, APAC discussed the capacity of space communications with Dr. Hayes. Part of this discussion noted the options for Deep Space Optical Comm (DSOC), but APD has not acted on this.

APAC has also discussed the Explorer program, which runs across SMD. Some APAC members had been on Explorer selection committees over the years. The suggestion was made that the selection process might benefit from a change to an earlier downselect based on science and feasibility, with stronger constructive review. This would allow for both mentoring and streamlined funding. APAC will be sending forward a recommendation to APD that there be a study to restructure Explorer roles. This may go beyond APD. Dr. Holley-Bockelmann noted that in regard to Diversity, Equity, and Inclusion (DEI), the current process takes a lot of workforce time.

Some EC individuals from Transform to Open Science (TOPS) and JWST gave a presentation on OSS. Dr. Holley-Bockelmann listed the four concerns about this, the primary one being that proposers and others in the community worry about eliminating exclusive access and being scooped. This is especially a concern for EC people. The presenters listed possible mitigations, which were very creative. APAC will recommend studying these.

TDAMM is the concept that we have an open window onto the universe. The Astrophysics DS recommended that this be the highest priority. TDAMM relies on SCaN, new infrastructure, and workforce development. Funding creates a strain here, but there are options. The Astrophysics Cross-Observatory Science Support (ACROSS) pilot project has discussed these in its first report. Some good news is that the European Space Agency (ESA), with NASA as a partner, has adopted the Laser Interferometer Space Antenna (LISA) gravitational wave mission, which is a step forward in TDAMM science. The mission will involve three spacecraft separated by millions of kilometers, creating a telescope as big as a star.

Biological and Physical Sciences Advisory Committee (BPAC)

Dr. Foster presented the BPAC report. This Committee is now official and is planning its first formal meeting for April. There was a “Panel of Experts” meeting previously. BPS is the smallest SMD division.

Most of the mission fleet is in low-Earth orbit (LEO), but there will be a new mission associated with Artemis, as well as the Commercial Lunar Payload Services (CLPS) initiative. There are multiple partnerships. Similar to APAC, there are many questions about OSS and open software. While BPS is committed to openness, there are concerns about exclusivity. At the April BPAC meeting, the Committee hopes to receive a briefing on the BPS DS, which was released in September 2023. The Division provided its formal response a week before this SC meeting.

Dr. Foster provided some science highlights from the biological side, which include plant and crop growth on the International Space Station (ISS), along with an investment in tissue chip research. A major concern is the continuation of such programs, given that ISS is nearing the end of its life. Physical science highlights include the Cold Atom Lab (CAL), Zero-Boil-Off Tank (ZBOT), and flow boiling research. These, too, depend on ISS. It is not clear how these projects can be done otherwise or if other Federal institutions can take them on.

Earth Science Advisory Committee (ESAC)

Dr. Tucker reported on the Earth Science Advisory Committee (ESAC). The Committee has a number of new members. Its only meeting in 2023 was for the Government Performance and Results Act Modernization Act (GPRAMA) performance review in the fall. There were two goals, both of which received Green ratings. Dr. Tucker explained that prior to the review, ESAC received a 154-page document highlighting 338 publications citing work supported by ESD. The document covered R&A efforts from six ESD focus areas.

The other topic discussed at the fall meeting was a report from the Unidentified Aerial Phenomena Independent Study Team (UAPIST), which is an ESAC subcommittee. ESAC had two findings:

- UAPIST addressed the questions outlined in the Statement of Task; and
- The scope of the report goes beyond ESD.

ESAC made a procedural recommendation that it did not have the expertise to make detailed recommendations and, therefore, the report should go to Agency leadership.

ESAC has a full meeting planned for mid-April, during which time it will also meet with the Applied Sciences Advisory Committee (ASAC). Dr. Tucker then described some ESD highlights, including a community forum on the budget, climate-change initiatives, and upcoming changes to AOS and the Earth Venture (EV) program. The Plankton, Aerosol, Cloud, and ocean Ecosystem (PACE) mission launched in February to study the oceans. In conjunction with the Indian Space Research Organization (ISRO), NASA is about to launch the NASA-ISRO Synthetic Aperture Radar (NISAR) mission, though there might be a delay due to an antenna issue. Dr. Tucker showed the Earth Science mission fleet and pointed out that it, too, has missions that last longer than expected, affecting the Division budget as a result. However, the benefit of this longevity is continuity of measurements.

Heliophysics Advisory Committee (HPAC)

Dr. Cassak began the HPAC report by listing the NASA Heliophysics objectives. HPAC has returned to a regular cadence of meetings, and the next meeting is tentatively planned to occur in June. Dr. Cassak listed the Committee members, many of whom are new due to old members dropping off to serve on the DS panels. HPAC now has a Vice Chair, Dr. Christoph Englert.

By the Division's very nature, the great majority of HPD missions are directed to the Sun, though there are plans to send missions to the Moon and to Mars. HPAC did its GPRAMA review in the fall, and Dr. Cassak showed some highlights. He also listed agenda items from the last two meetings. The November 2023 meeting resulted in 12 F&Rs, and the February 2024 meeting generated 18 F&Rs. Of particular note from the November meeting were the hiring of Dr. Joe Westlake as HPD Director; outreach activities for

the upcoming solar eclipse; successful launch of the Atmospheric Waves Experiment (AWE); establishment of the HELiophysics Strategic Technology Office (HESTO); and significant space weather activities under the auspices of the Space Weather Council (SWC), an HPAC subcommittee. The Heliophysics Big Year (HBY) is an initiative to engage the public and the science community with this area of science during a period of intense Sun-related activities such as the upcoming solar eclipse and the solar maximum. Dr. Cassak listed HBY activities internal to NASA.

At the February meeting, there was much discussion of GDC, which was only delayed at that time. However, there was concern at the meeting that the mission could be canceled, which has now occurred. GDC was a flagship mission recommended by the Heliophysics DS. HPAC was also concerned about the level of overall funding and the portfolio balance.

There has always been some tension between HPAC and HPD about the level of information HPD shares with HPAC about R&A. It has become evident that other DACs receive more information in this area, and HPAC made a recommendation that this be investigated and explained. Another issue is that of requirements for Inclusion Plans (IPs) in proposals. Some states are not allowing DEI to be mentioned. There is also inequity in access to resources, with concern that some proposers must use grant money to support IPs. HPAC would like HPD to set aside some funding for this purpose, and would also like to see this discussed at the SMD level.

Planetary Science Advisory Committee (PAC)

Dr. Hope Ishii, PAC Chair, listed the Committee membership. There will be a new Executive Secretary, and announcement of a Vice Chair is pending. PAC meets on a regular cadence three times per year. The next meeting is likely to be in July.

Science highlights from PSD include the recovery of samples from the Origins, Spectral Interpretation, Resource Identification, and Security-Regolith Explorer (OSIRIS-REx) mission to Bennu, an asteroid near Earth. Recovery was complicated by difficult removal of screws from the sample container, but that was finally resolved. Europa Clipper is set to launch later this year. Dr. Ishii cited an undergraduate research program for Clipper that drew more than 3,500 applications. The Juno mission is in extended operations and has done some low-altitude flybys. Two CLPS missions had problems; a propellant leak in the case of Peregrine and a tilted landing by Odysseus. Both sent back usable data nonetheless. Finally, while the Ingenuity helicopter was intended as a technology demonstration on Mars, it was so successful that it managed 72 flights before damage to a rotor grounded it.

Dr. Ishii showed the agendas from the November 2023 and March 2024 PAC meetings. The 2023 GPRAMA review resulted in all Green ratings. There were many presentations, which are available on the PAC website. Several findings from the November meeting might be of interest to the SC. These address:

- The structure and membership of Standing Review Boards (SRBs);
- Support for the MSR in the face of budget challenges, which was reiterated at the March meeting;
- The impact of mental health on science products, with the possibility of SMD workforce assessments in this area; and,
- The possibility that PSD will merge several of its programs, which PAC would like to see delayed and which the Division has agreed to do.

Regarding the mental health finding, Dr. Ishii explained that PAC had received a presentation on this topic. While the Committee would like PSD or SMD to delve more deeply into this, PAC members also acknowledged that it can be a challenge to do such surveys. However, this could be something that professional societies might sponsor and implement.

At the March meeting, PAC reaffirmed support for DS priorities. Other findings include:

- There is a need to ensure that compelling science is a pillar of the Moon-to-Mars (M2M) program;
- DSN capacity remains a concern; and,
- PAC appreciated PSD and SMD for their successful advocacy of a limited exemption allowing NASA-funded researchers access to Chinese lunar samples.

Possible topics for the next meeting include the role of MSR in Mars exploration, DSN, an Exploration Science Strategy Integration Office (ESSIO) update, and others. Dr. Ishii closed by showing the Planetary fleet chart.

Discussion

Dr. Foster asked Dr. Cassak for clarification of his comments regarding the differences in the information that the DACs receive. Dr. Cassak explained that HPAC always asks for more information but has not received it until recently. It has come to light that the Committee receives less information than the other DACs. When they looked at the APAC minutes, for example, it became clear that that Committee receives much more information from APD than HPAC does from HPD. This suggests that the lower level of information was due to an HPD decision, so HPAC asked about that. Dr. Westlake has agreed to investigate. Dr. Ishii pointed out that Dr. Westlake had been on PAC and therefore is familiar with what PSD provides, which seems to be more than what has come from HPD. Dr. Foster said she will be alert to this issue when BPS presents to BPAC.

Dr. Tucker asked Dr. Holley-Bockelmann for clarification about LISA, which she had thought was already in progress. Dr. Holley-Bockelmann said that the planning for LISA did indeed begin long ago. For ESA, “adoption” is the term used to mean that they now have a funding line for the mission; it is now a formal selection that will eventually fly. At NASA, LISA can now move into a project office under the Explorers program. Dr. Tucker asked Dr. Ishii if PAC had discussed integrated technology development for future planetary science missions. Dr. Ishii replied that there has not yet been a direct update, and the Committee might ask for a presentation on it at the July meeting.

Dr. Williams asked Dr. Tucker about the size of the gradiometer project and the need for higher resolution. Dr. Tucker said that she would find out. Dr. Godwin said that in the BPAC discussion, there was mention of ISS being decommissioned at the end of the decade. However, there are commercial space stations in design and in various phases, and there has been discussion of moving some of the science to them. She wondered about where this might go, not just for BPS but for any group, and if there is a transition process or if the commercial stations are more proprietary. She also wondered if this involves SMD or a different NASA directorate. Dr. Foster said that there is a need to push on this, as it is an incredibly important discussion. In listening to reports from the other DACs, she has realized that the other SMD divisions have actual missions with their own spacecraft, while BPS does not. Nor does the Division control funding to get to space. There are questions about whether there will be a national lab on one of these commercial space stations, and what the timeline might be. Six years is not long, and the commercial efforts are all still in design and development. No clear path has materialized, and this is high on her list of topics. While she would not be surprised if ISS extends beyond 2030, that is just putting together what people tell her.

Dr. Cassak expressed interest in the mental health survey and the related activities, because he had not previously thought of NASA as weighing in on the topic. He wondered where PSD fits in. Dr. Ishii said that this is a tricky subject, in part because NASA may be interested in the mental health of its own workforce. The study was a voluntary survey that sought to assess stress, depression, and anxiety among those in planetary science. It was done as part of a graduate degree project in psychology. The study

found significant levels of increased anxiety and depression in some groups within the planetary science community, affecting respondents' work, home, and social lives. There is an interest in understanding the broader mental health picture in this population, as well as others. However, NASA is neither equipped nor charged with looking at the mental health of the broader community. At the same time, the DS called for a workforce assessment, which would be challenging. It does not appear to be in NASA's purview, there are legal issues, and further work will probably need to be done by a professional society. The planetary area is complicated by the fact that there are so many constituent communities, and no one professional society covers them all. Dr. Tucker said that Earth Science also has a lot of subcommunities, but NASA is responsible for setting an example in things like how people treat their grantees.

Dr. Tucker added that in ESAC, they are told what the agenda will be. She was getting the impression that the other DACs are more participatory. This was part of the larger issue of consistency across the DACs. Dr. Cassak explained that while APAC gets input from the community via its dashboard, HPAC has been told they should not do that, which is another inconsistency. Dr. Holley-Bockelmann thought that was strange. The dashboard came about as a way for APAC to organize its public comments. They set up the dashboard in advance, announce it via social media and other means some days ahead of the meeting, people write their questions and comments, and the public votes. Regarding the agenda, APD formally sets the APAC agenda, but there is input from the Committee before the Division finalizes the agenda. Drs. Ishii and Foster said that that was the way it worked for their DACs, and Dr. Cassak said that HPD has been very collaborative in setting the agenda. Dr. Foster added that the length of the ESD GPRAMA report was a surprise, and it sounded like the amount of information varies.

Mr. Boll thanked the DAC chairs and added that SMD will take requests for agenda topics for meetings.

Public Comments

The meeting was opened for public comment, but no one came forward.

While waiting to see if there would be any comments, the SC members further discussed the APAC dashboard and the fact that one comment for the recent meeting received 464 upvotes. When asked how SC meetings are advertised, Mr. Boll said that there are announcements on the NASA website and in the Federal Register 2 weeks in advance.

Committee Discussion

Dr. Williams said that she liked to pair findings and recommendations, while also keeping them short. Her first thought was to commend SMD for working to mitigate budget impacts, and for prioritizing and maintaining great operations and the workforce in NASA areas of interest. She was not sure why DPC was limited to ESD, as it seemed like a useful approach.

Dr. Bakhtian said she was surprised not to see an actual budget, and she was not sure how the decisions were made and what exactly was done. This makes it difficult to advise. She wondered if that might be the subject of a future briefing. If SC members are being asked to weigh in, they need more data, as well as the stories behind the data. She also wondered about DPC. If it is a good approach for addressing budget challenges, they should be doing it all the time. However, she was concerned that decoupling could lead in the wrong direction, resulting in siloing. Dr. Williams thought the decoupling related to launch dates, so that a specific sequence of launches was no longer required. Dr. Tucker explained that DPC was directed at the AOS mission specifically, although she agreed that the approach could go beyond ESD. AOS was originally meant to be quite large with multiple spacecraft in two orbits. One of the spacecraft was to have a high-capability LiDAR and a high-capability radar. However, it has been descope due to costs. International partners have been brought in, and some of the mission is being competed. Regarding the decoupling in particular, that is an effort to reimagine the mission so that measurements can be obtained without such intense power needs. There were a lot of systems and

observations in ESD's A Train constellation of missions, which were designed to follow each other closely rather than be packed on the same spacecraft. The AOS objective was to have everything on the same platform for simultaneous observations, but that has been a challenge, especially with the budgets becoming more of an issue. The decoupling spreads out some of this among spacecraft and various international agencies. The goal is to get the measurements and maintain continuity. The compete element of DPC is complex, because it may interfere with other competitions that are already planned. Ms. Joy Burkey noted that Dr. Fox had provided additional information that the new competed element of AOS does not displace a future ESD Explorer Announcement of Opportunity (AO). The competed element of AOS will be Explorer-class and managed by the same program office. Strictly speaking, it is not an Earth Explorer, however.

Dr. Williams observed that failure of the budget to grow as expected often runs headfirst into DS recommendations. Dr. Ishii said that PSD is facing some tough choices but the community is coalescing around maintaining DS priorities. Dr. Williams noted that all divisions would like to do that. Dr. Foster asked if this calls for more shared research among divisions. Dr. Williams said that partnerships will get a mission up but may not capture a breadth of effort. Dr. Cassak said that one of the issues with the proposed cancellation of GDC is that it was a flagship in the last DS, and the next heliophysics DS is close to release. In addition, the Dynamic mission relies on GDC. The community is concerned and it is hard to know what to recommend. It might help to ask for more transparency in decision-making, but it may be that that is not realistic. PSD takes the biggest budget hit overall, while HPD is reasonably flat. Dr. Foster wanted to recommend that the budget be included in future briefings. Dr. Tucker and others agreed. Dr. Bakhtian thought the larger issue was about what was being asked for in terms of feedback on the budget. It was noted that the FY24 information was incomplete. Dr. Williams said that the SC would have a F&R acknowledging the difficulties of dealing with rough budget scenarios and asking that each SC meeting include a budget presentation that also covers some of the balancing considerations and how NASA came to the final conclusion.

Dr. Boll clarified the differences between F&Rs and resolutions. Resolutions are for comments like welcoming Dr. Fox, recognizing good work, etc. F&Rs are critiques and advice.

Dr. Ishii asked if the SC could ask for more frequent NAC meetings. Dr. Williams said that the finding is that the SC has not been able to forward its F&Rs to the NAC. The recommendation is that the NAC should have a regular schedule for meetings, with that schedule being published well in advance. It is frustrating that the meetings have been so infrequent, and it was not always like this. Others agreed, especially since the SC has important pending F&Rs related to SCaN and DSN.

Dr. Holley-Bockelmann repeated her concern about the OPCR evaluation of Chandra and HST. Previous SRs reported to APAC, which has been cut out of the process along with the rest of the astrophysics community. There has been no discussion of the OPCR Terms of Reference (TOR) or what elements the review panel will consider. The SRs had guidelines and principles; these are unknown in the case of the OPCR. This feels like a bait-and-switch, and it happened too quickly. When the plans were for a mini-SR, there was no option to cut the missions, but the description of the OPCR does include that, which is concerning. These missions are beloved in the community and much R&A work depends on them.

Dr. Bakhtian was concerned about the pending departure of Dr. Williams as SC chair and who would be presenting the SC F&Rs at the next NAC meeting. She thought they would have more impact if Dr. Williams were presenting. Dr. Williams said that she would be involved in drafting the F&Rs from this meeting and repeated her intention to informally contact someone high in NASA expressing her disappointment and concern about the situation. She will be happy to talk with the new chair when that person is appointed. She will no longer be the SC chair in May, which is believed to be when the next NAC meeting will occur. However, it is not unusual for outgoing chairs to brief incoming chairs, which

she is happy to do if needed. When asked if the SC members might meet the new chair before the NAC meeting, Mr. Boll said that that was possible. He added that NASA is in the process of appointing a new chair and new members, which involves multiple steps, but there are alternatives like designating a vice chair to bridge any gap. That might also help with the continuity question. Dr. Tucker thought that having a vice chair would be incredibly important.

She added that ESAC does not appear to weigh in on Senior Reviews (SRs), though it seems important to involve the community in the SR process. The Earth Science SR does not bring its report to the Committee and is not a subcommittee of ESAC. Dr. Cassak noted that the HPD SR does not report to HPAC.

Mr. Boll said that procedurally, the recommendation regarding NAC meetings would have to be directed at NASA. It would have to go through the full NAC, however. Dr. Foster asked if the SC might be able to deliver an unofficial version of the report or F&Rs. Mr. Boll said that they cannot circumvent the system. This discussion is done in public. There is an action to look at ways to move things forward more quickly. He noted that the chair of each DAC is on the SC, and they have the capacity to advocate to their division directors for relevant F&Rs. There are no rules against multiple DACs advocating on the same topic, though he cautioned against the SC trying to control the DACs. He will give this further thought. Dr. Williams said that even if the SC could deliver a report to Dr. Fox, she is constrained until NAC approves it. Mr. Boll said that that is correct. The concurrence and response must involve an official document. He would check with the General Counsel's (GC) office to see what might be possible via the debriefing. Dr. Williams said that the Committee wants its F&Rs to be crisp and impactful. There should be an F&R on NAC meeting regularly and addressing SC inputs.

There should also be a finding expressing appreciation of SMD's effort to deal with the budget but also a recommendation seeking a more transparent process. There will be an F&R about the OPCR in APD, stating that the SC is unclear on the transition to that process from the mini-SR. Dr. Holley-Bockelmann asked that she add that APAC is disappointed that it could not advise on things that would be important for the Committee to consider.

Dr. Ishii said that the two key findings out of PAC were concern about DSN and ensuring that science is a pillar of M2M exploration. Dr. Williams said that the previous F&Rs were very pointed. She asked Mr. Boll and Ms. Burkey to send copies of those to the SC members. It was noted that the DSN recommendations have been the topic of a science publication's discussion and that the community is very involved in the conversation. Dr. Williams said it would be good to hear from the new head of SCaN. Part of the problem is that the budget does not come from SMD but is developed elsewhere in NASA. She believed Dr. Fox was aware of these concerns.

Dr. Cassak asked about proposing an SMD fund for people needing assistance with IP requirements and issues. Dr. Williams said that the SC has been concerned about that all along. Dr. Holley-Bockelmann said that while the concern is about the money coming out of science funding, she personally believes DEI is part of science. Dr. Williams said that she has hired professionals to ensure DEI is done well. Dr. Bakhtian wanted to hear more on this because it is a complicated space and there should be some discussion about whether the DEI funds should go to the organizations rather the PIs. Dr. Foster said that she wanted to hear NASA come up with a plan for people from states where DEI is banned. The researchers in those states need a response. Dr. Williams said that one approach is to shift the language to independent characteristics such as whether a person is the first from their family to go to college or grad school, etc. Dr. Foster said that at the University of Florida, the DEI people have been fired or reassigned.

Dr. Williams reviewed the key concerns from the DAC reports. These included DSN; ensuring that the M2M program has science as a central pillar; the state DEI issue and unfunded mandates; consistent

information from the divisions to the committees; and the frequency of meetings. Dr. Cassak said that Dr. Fox came from HPD, which did not share the same information as the other divisions, so he was concerned about the possibility that the recommendation could backfire, resulting in the information no longer being shared in any of the DACs. As an example of the kinds of information in question, HPAC has asked for R&A funding rates as a function of ratings. However, they do not get that information even though the Committee members believe it would help them provide better advice.

There was some question as to why ASAC is not part of the SC. Mr. Boll said that it is a separate committee that has never been part of the SC structure. If the SC wants to include it, there is a process to follow. Dr. Tucker said that the chair of ASAC sits on ESAC. Her understanding is that ASAC uses Earth Science work, though that does not preclude overlap with other areas. Dr. Bakhtian asked if there might be a longer briefing on climate change strategy and efforts across all of NASA. She has asked for this previously, and she wanted to specify climate change in contrast to climate. Dr. Ishii said that she had had a chance to look at the previous findings on DSN. It looks like those findings did not recognize the extremely tight budget situation that currently exists. She suggested acknowledging the budget constraints in any new DSN F&Rs. The SC might also ask for information on priorities and strategies in the face of limited funds. Dr. Foster wanted to see how the other mission directorates might contribute to the conversation, since DSN cuts across all of NASA. Dr. Williams said the F&R should emphasize the need for a concentrated effort now that the budget is tight.

For the F&Rs from this meeting, she and Ms. Burkey would do the wordsmithing after the meeting; at the moment, she hoped to develop content since that had to be decided in public session. She reviewed the draft budget F&R, which would address how cuts were decided, the trade space for decision-making, and other factors taken into consideration when crafting the budget. The SC would like the budget numbers to be part of the main presentation. The Committee cannot reasonably comment on the budget without this additional information. It is important to know the rationales and the kind of feedback NASA wants.

On the topic of more frequent and regular NAC meetings, the SC is concerned that NASA SMD is not receiving or able to act on timely information from the Committee due to regulations restricting the flow of communications. In addition, there is inconsistency across the DACs. The recommendations are to have more frequent NAC meetings, possibly allowing the DFOs to share with SMD, and to consider how the DACs can be more consistent with each other. Ms. Burkey shared with the Committee a graphic she had created that showed the meetings for NAC, SC, and the DACs from 2019 to the present. [Figure under Briefing to NASA, below.] She observed that during that time, the SC has met 14 times but the NAC has met only 5 times.

Dr. Williams reviewed the August 2023 SC meeting's F&Rs on the topic of DSN. When there is an opportunity to present to the NAC, the SC chair will refer back to these. Similarly, she reviewed the F&Rs related to TOPS and OSS, as well as those addressing DEI. At this meeting, the SC added two recommendations, one that NASA provide recommendations on how projects can incorporate IDEA without taking funding away from direct R&A activities, and the other for the Agency to offer recommendations on how projects might deal with IDEA requirements if their states disallow it. Dr. Holley-Bockelmann noted that APAC is also making this IDEA recommendation. A new TOPS recommendation from the SC was for NASA to do a formal study on how to protect researchers.

Mr. Boll and Dr. Williams discussed how to ensure that the F&Rs from the three SC meetings were distinct. Mr. Boll reminded the SC that open software was now part of the conversation in addition to OSS. Dr. Williams suggested a new set of F&Rs on open software and IDEA. A discussion followed about whether to recommend monitoring mental health across the workforce. Dr. Williams said she was not in favor of such a recommendation.

Dr. Bakhtian repeated her request to make NASA's climate change strategy the focus of a future meeting; Dr. Williams requested this as a draft recommendation, noting that it is especially important in the face of budget cuts. Dr. Bakhtian also asked if the SC members could receive information in advance, and said she wanted to know more about planetary protection. Dr. Ishii said that PAC receives regular briefings on planetary protection.

Dr. Williams listed other topics that came up during the meeting, including:

- Transparency in decision-making
- The many DSEs and priority-setting
- DPC (Decouple, Partner, Compete)
- Science at the borders of communities
- More on the reasoning behind cancelling GDC
- More on SCA and DSN resources, allocation, and prioritization
- Changing the astrophysics mini-SR to the OPCR
- Science in M2M
- Consistency in information access across the DACs, also frequency of meetings
- NAC meetings
- Endorsement of the joint ESAC and ASAC meeting
- Climate change
- The need to know what kind of feedback NASA wants from the Committee

Resolutions were proposed to laud the new HPD and BPS directors, and to praise and thank Dr. Williams for her leadership as SC Chair.

Briefing to NASA

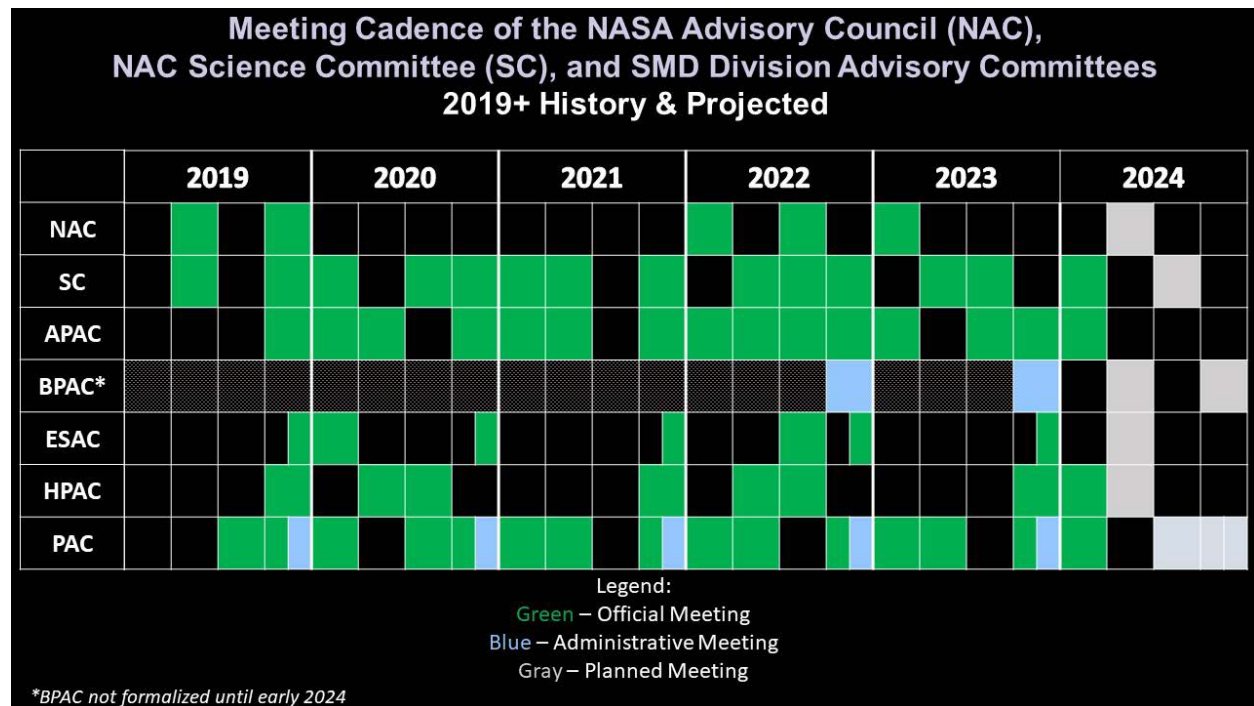
Once Dr. Fox rejoined the meeting, Dr. Williams presented the outbrief. She began by noting the lively discussion. She then thanked SMD for all of its hard work on the budget. The SC appreciated receiving the science highlights. There was a great deal of discussion about what kind of feedback SMD needs from the SC and what would be most useful. The SC believes SMD needs to hear input on how SMD can best communicate to the Committee and the science community. The SC would like to know more about what is going on with budget decisions, including how these decisions are made and how that process might be improved. This is hard and troublesome, and SC members understand that the budget situation is complicated by Decadal Survey priorities that are difficult to fund. In future meetings, the Committee wants to hear more about the bases of decisions, how those factors impact the budget, the Decadal Surveys' priorities, the known consequences, and how all those factors come together. To the extent it can be done, this would help in the SC function of providing advice.

A more focused concern was that in regard to HST and Chandra, the Agency transitioned from a mini-Senior Review to a completely different kind of review, the OPCR. It is not clear how that works and it would help to have communications on that. Dr. Fox agreed about getting out a clearer message. Dr. Williams then said that the SC is also concerned that NASA does not seem quite serious enough about the advisory committee process as suggested by the infrequency of NAC meetings. The SC has urgent F&Rs that are not being heard because of this. Another concern is that there are significant differences in what information the DACs receive, how often they meet, etc. While avoiding rigid rules, some guidelines would be helpful to ensure the DACs get similar kinds of information, meet regularly, etc. Dr. Fox replied that that was good feedback. SMD did hear last time about the input and the DACs meeting. They should all have met by now and perhaps they can be further equalized. Dr. Williams added that they heard that HPAC has resumed a regular cadence of meetings, and also that ESAC and ASAC are meeting jointly, which is good. She noted that ASAC does not fall under the SC and it was not clear whether that should be changed.

Another topic was DSN. The SC had serious F&Rs from the two previous meetings and would like a presentation about SCaN. The Committee is increasingly concerned about DSN, which affects SMD missions. This goes back to prioritization and decision frameworks. Dr. Fox said that if there is something they want on the agenda, they should tell her what kind of information they need. There will be a DSN briefing and SCaN update.

Dr. Williams noted the desire to revisit climate change and planetary protection at future meetings, especially in context of how the constrained budget might be affecting priorities and decision-making. The SC also talked about important activities supporting science, such as open science and software, and all things DEI. Again, the SC is concerned about these areas in the face of budgetary pressures. One of the divisions is working on some good ideas about implementing open source software. There is also the issue that some states prohibit considering DEI. The SC wants to know NASA’s thinking about that. Dr. Fox said that they could have Ms. Elaine Ho, the IDEA lead, present at a future SC meeting.

When asked if there were further comments, Dr. Tucker clarified that thus far, ESAC has not met except to do the GPRAMA evaluation. Ms. Burkey provided an updated version of her meeting chart, below.



Dr. Fox thanked the SC members for their hard work. She is trying to visit each DAC meeting and asked the chairs to make sure their DFOs contact her. If SMD needs to discuss something and provide more information, the SC should please tell them.

Mr. Boll thanked Dr. Williams for her leadership.

Adjourn

The meeting was adjourned at 4:51 pm.

Appendix A
Participants

NAC Science Committee Members

Dr. Ellen Williams, University of Maryland, *Chair*
Dr. Noël Bakhtian, Bezos Earth Fund
Dr. Paul Cassak, West Virginia University
Dr. Jamie Foster, University of Florida
Dr. Linda Godwin, University of Missouri
Dr. Kelly Holley-Bockelmann, Vanderbilt University
Dr. Hope Ishii, University of Hawaii
Dr. Sara Tucker, Ball Aerospace
Mr. Nathan Boll, NASA Headquarters, *Designated Federal Officer*

Other Participants

Linda Billings	Jack Kiraly
Sky Bischoff-Mattson	Jennifer Kovacev
Stacey Boland	Kate Kronmiller
Francesco Bordi	Michael Lehner
Stephanie Buehler	James Lochner
Joy Burkey	Amanda Marroquin
Christopher Caisse	Gene Mikulka
Lin Chambers	Erica Montbach
Bruce Cook	Asal Naseri
Michael Croteau	Kirsten Petree
Anton Darmenov	Griffin Reinecke
Darcy Elburn	Amy Reis
Sylvie Espinasse	Catherine Rice
Michael Fanelli	Corneilius Robinson
Jens Feeley	Richard Rogers
Jeremy Fehrenbacher	Katherine Rohloff
Jeff Foust	Andrew Rowe
Nicola Fox, <i>SMD AA</i>	Elisha Sauers
Louis Friedman	Elizabeth Sheley
Veronika Fuhrmann	Bishwas Shrestha
Jason Ginn	Heather Smith
Janine Harris	Marcia Smith
B. Harvey	Paul Voosen
Hashima Hasan	Kiri Wagstaff
Paul Hertz	Z. Wai
Thomas Gadd	Bradley Williams
Lissa Jordin	Matthew Zajac
Van Kane	Eric Zirnstein
Jennifer Kearns	

**Appendix B
NAC Science Committee
Membership**

Dr. Ellen Williams (Chair)
University of Maryland

Mr. Nathan Boll (Designated Federal Officer)
NASA SMD

Dr. Noël Bakhtian
Bezos Earth Fund

Dr. Paul Cassak
West Virginia University

Dr. Jamie Foster
University of Florida

Dr. Linda Godwin
University of Missouri

Dr. Kelly Holley-Bockelmann
Vanderbilt University

Dr. Hope Ishii
University of Hawaii

Dr. Sara Tucker
Ball Aerospace

Appendix C
Presentations

1. SMD Update and Budget Presentation; *Nicola Fox*
2. APAC: Astrophysics Advisory Committee Report; *Kelly Holley-Bockelmann*
3. BPAC: Biological and Physical Sciences Advisory Committee; *Jamie Foster*
4. ESAC: Earth Science Advisory Committee Report; *Sara Tucker*
5. HPAC: Heliophysics Advisory Committee Report; *Paul Cassak*
6. PAC: Planetary Science Advisory Committee Report; *Hope Ishii*

**Appendix D
Agenda**

**NASA Advisory Council
Science Committee
Meeting
March 25, 2024**

Monday, March 25, 2024 (Eastern Time)

10:00-10:05	Call to Order	Nathan Boll Executive Secretary
10:05-10:15	Introduction of Members/Summary of Agenda	Ellen Williams Chair
10:15-11:15	SMD Update and Budget Presentation	Nicky Fox Associate Administrator, Science Mission Directorate
11:15-12:00	Committee/AA Q&A	
12:00-12:45	<i>Break (45 min)</i>	
12:45-2:15	Division Advisory Committee (DAC) Chair Reports Kelly Holley-Bockelman, Astrophysics Advisory Committee (APAC) Jamie Foster, Biological and Physical Sciences Advisory Committee (BPAC) Sara Tucker, Earth Science Advisory Committee (ESAC) Paul Cassak, Heliophysics Advisory Committee (HPAC) Hope Ishii, Planetary Science Advisory Committee (PAC)	
2:15-2:30	Public Comments	
2:30-2:45	<i>Break (15 min)</i>	
2:45-4:15	Committee Discussion	
4:15-4:30	<i>Break (15 min)</i>	
4:30-5:00	Briefing to NASA	Ellen Williams Chair; Nicky Fox Associate Administrator, Science Mission Directorate
5:00	<i>Adjourn</i>	