NASA ADVISORY COUNCIL

HELIOPHYSICS ADVISORY COMMITTEE

April 5-6, 2018

NASA Headquarters
Washington, D.C.

MEETING MINUTES

Michael Liemohn, Vice Chair

Janet Kozyra, Executive Secretary

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Thursday, April 5

Welcome, Overview of Agenda

Dr. Janet Kozyra, Executive Secretary for the Heliophysics Advisory Committee (HPAC) of the NASA Advisory Council (NAC), opened the meeting. Dr. Jill Dahlburg, HPAC Chair, welcomed the Committee members and had them introduce themselves. She then reviewed the meeting agenda.

Heliophysics Division Overview and News

Ms. Peg Luce, Acting Heliophysics Division (HPD) Director, welcomed the HPAC members and thanked Dr. Dahlburg for her years of Committee leadership. She then gave an overview of her presentation. HPD aligns with NASA's Science Mission Directorate's (SMD's) strategic objectives. These objectives call on HPD to advance national science and exploration goals, safeguard and improve life, and execute a balanced and integrated science program. As the exploration focus has shifted from Mars to the moon, HPD will be more involved in that effort. The Division's space weather efforts are part of safeguarding and improving life.

HPD has had some significant organizational changes. Dr. Nicky Fox will be joining NASA as the HPD Director in August, while Dr. James Spann is the Division's Acting Chief Scientist. Dr. Elsayed Talaat has taken a position outside of NASA, while Drs. Lika Guhathakurta and Mona Kessel are on detail at NASA centers. Drs. Terry Onsager, Roshanak Hakimzadeh, and William Atkinson are on detail with HPD. Dr. Dan Moses is Chief Technologist for the Division. Ms. Luce explained the distinction between program executives and program scientists. The executives typically come from the engineering side of the house, and they lead flight and project management, while the program scientists are responsible for science objectives. This structure also applies to missions.

HPD priorities reflect those of the Decadal Survey (DS) issued in 2013. The first DS priority is to complete the current program, which is being done. Implementation of the Diversify, Realize, Integrate, Venture, Educate (DRIVE) Program is the next priority, and the DRIVE budget has been healthy thus far. The DS also recommended that HPD accelerate and expand the cadence of the Explorer program to every 2 to 3 years, which is being done. The last Explorer Announcement of Opportunity (AO), for small Explorers (SMEXes), was issued in 2016, and while there were plans to issue an AO for Medium-class Explorers (Mid-EXes) in 2018, there has been discussion about delaying it somewhat in order to complete the SMEX selection process first. Any delay would still result in the AO being in the recommended cadence, however. Dr. Bart De Pontieu thought the Mid-EX announcement should be delayed. Ms. Luce noted that HPD currently has the funds and would prefer to spend the money while it is available. Dr. Heather Elliott observed that she got mixed input when she took this issue to the science community.

Ms. Luce said that the Interstellar Mapping and Acceleration Probe (IMAP) call was released, and Step 1 selections were pending. HPD held off on a Mission of Opportunity (MO) announcement that would have gone with IMAP in order to provide some space between calls. The Solar Terrestrial Probe (STP) program was being restructured. The Division was also forming a Science and Technology Definition Team (STDT) for the Geospace Dynamics Constellation (GDC), which issued a Request for Information (RFI) for innovative ideas. There were 65 responses to the RFI. Formulation will not start in earnest until Fiscal Year 2020 (FY20).

The FY18 budget appropriation included augmentations for space weather, the Wallops Research Range, CubeSats and smallsats, technology investment, and the Early Career Investigator Program (ECIP), as well as minor changes in missions in extended operations. Both the Ionospheric Connection Explorer (ICON) and the Space Environment Test (SET) bed now have launch dates in June, 2018. SET has been

hard to schedule. The European Space Agency (ESA) can no longer support a 2019 launch for the Solar Orbiter, and has now planned to launch in 2020. NASA's Global-Scale Observations of the Limb and Disk (GOLD) mission launched in January, as planned. The Parker Solar Probe (PSP) remains on track for an August launch. The launch delays are covered within the budgets for the missions, so they do not require additional funds or take funds from other budget lines. Solar Orbiter has potential for additional issues, but it is too early to say what will happen.

The HPD budget grew from $679 million in FY17 to $688 million in FY18. Between operating budgets and other adjustments, this comes to an additional $10.7 million. The augmentation will go to Space Weather, which is covered under the Living with a Star (LWS) science budget line. Within that LWS budget line, there is now a Space Weather and Applications line. Ms. Luce next reviewed the DRIVE increases recommended by the DS. Without including the Sounding Rocket Program, the competed grants funding in FY18 is 76 percent greater than that for FY15, with projected increases of 96 percent in FY19.

Dr. George Ho asked whether the delay in the Astrophysics Division's (APD's) James Webb Space Telescope (JWST) affects the overall SMD budget. Ms. Luce said that that has yet to be determined. It is a concern, but so far there has been no spillover to HPD. Dr. De Pontieu noted that missions other than DRIVE seemed to be flat. He asked if there were a rationale, and whether inflation had been considered. Ms. Luce replied that there was no rationale. Following the Senior Review (SR), HPD accommodated nearly all of the requests for extended missions, including some requests for increases. Dr. De Pontieu was concerned that not correcting for inflation will affect the missions at some point. The expertise needs to be kept and those people need to be funded. There is a point at which NASA must address this. Dr. Spann agreed that it would be good to reassess the requirements and funding profiles in order to explore efficiencies and the budget floor. HPD is in the process of evaluating individual missions with that in mind. He noted that the HPD budget does not accommodate inflation, and increases for older missions will cut into funds for new missions. The current evaluation has the goals of more accuracy and further savings, where possible. It is not simple, and will take effort and work with the individual missions.

Ms. Luce said that the FY19 PBR assumes a flat budget going forward. There are many factors at play, however, and the out-years are notional. The flat budgets do not affect DRIVE, which will continue at the current level at least. The Sounding Rockets Program is for all of SMD, which is why she pulled it out of the funding chart for DRIVE. The space weather augmentation includes working with the National Science Foundation (NSF) on the Community Coordinated Modeling Center (CCMC) facility, and LWS strategic capabilities. There is a new NSF-NASA funding opportunity, Computational Aspects of Space Weather, and the Agency is also enhancing its collaborations with the National Oceanic and Atmospheric Administration (NOAA). A pilot among these three agencies addresses operations to research (O2R) activities, for which NASA plans a Research Opportunities in Space and Earth Sciences (ROSES) announcement.

For ROSES 17, the Supporting Research (H-SR) and Guest Investigator (H-GI) panels for the Magnetospheric Multiscale (MMS) are complete, with estimated selection rates expected of around 20 percent. The Heliophysics Technology and Development for Science (HTIDES) selection rate rose from 10 to 39 percent, reflecting a greater investment. The Heliophysics Data Environment Enhancements (H-DEE) call selected all nine proposals submitted. When asked about the percent change in the funding levels, Ms. Luce explained that there will be a detailee joining HPD soon, and she will be developing that kind of information. Dr. Dan Moses added that SMD had previously had a single CubeSat program, but now each division has its own, with more funding. DRIVE brought in another $5 million. DRIVE is meant to do new things instead of just more of what HPD had been doing. Ms. Luce said that the Instrument Technology Development (ITD) Program tripled its selections, from 4 to 12.

Dr. James Klimchuk said that this was good news overall, and it is important to expand ITD and rockets. However, there is concern that the traditional programs are not seeing as much of an increase as the science community would like. Ms. Luce replied that she would look into it. The HTIDES and ITD increases are real, and CubeSats will enable more science. Dr. Klimchuk said he would like to further discuss the viewpoint that HPD should increase the core research programs. Dr. Dahlburg suggested that there be a specific talk on this topic at the next meeting to determine if corrections are needed. Dr. William Matthaeus added that there is concern that people will leave the field over some of the low funding rates. Rates should be 20 percent and above. Dr. Dahlburg repeated her recommendation for a more in-depth discussion at the next meeting.

Dr. Elliott was concerned that the space weather emphasis has become more specific than what was in the strategic plan. Ms. Luce replied that space weather has strong support within SMD. HTIDES is being restructured to expand ITD and the Laboratory Nuclear, Atomic, and Plasma Physics (LNAPP) Program, while the Low-Cost Access to Space (LCAS) Program is being divided into CubeSats and suborbital missions. The Research and Technology (R&T) Prime program will now support larger investigations. HPD also has collaborations with the NASA Planetary Science Division (PSD) and APD. NASA and NSF will collaborate on the design of the Heliophysics Science Centers, and have a joint solicitation on ICON and GOLD opportunities.

Regarding international partners, the Korea Astronomy and Space Science Institute (KASI) and NASA have agreed to collaborate on a prototype coronagraph for balloon flight, to fly in 2019. There is a joint working group and three subgroups examining collaboration possibilities with the Indian Space Research Organisation (ISRO). The Japanese Space Agency (JAXA) is working with NASA on an approach for the Next Generation Solar Physics Mission (NGSPM). At the moment, both agencies have smaller, competitive missions that would meet some of the mission objectives, and ESA will not be contributing to this effort. JAXA does not have the budget to lead the effort, so the two agencies are going to let the competitions play out. However, HPD's next Mid-EX could provide an opportunity to move this partnership forward. The next DS will come along in that timeframe, possibly with an endorsement of this mission. For now, however, neither NASA nor JAXA has the full budget for the effort. Dr. De Pontieu was concerned about the delay of the larger mission, though the solar physics community would endorse the smaller missions. Dr. Moses noted that the small missions would not fill all of the objectives. Dr. De Pontieu replied that the frustration has been that big missions often fail to meet expectations. Dr. Dahlburg sought clarification of the goal, and Dr. Klimchuk observed that it would be better to get some of the measurements than none of them. Ms. Luce explained that this will not be a strategic mission, and the smaller missions must be competitive. Dr. Dahlburg said that there needs to be a case made for the mission.

Dr. Tomoko Matsuo asked about discussions with ESA about other opportunities. Dr. Spann explained that ESA is seeking more grass roots efforts instead of just agency-to-agency discussions. He noted that ESA competes across all disciplines, rather than making the distinctions that NASA does.

Ms. Luce then noted additional mission details. The top three issues begin with PSP, which has had a few failures of the platinum resistance thermometers, although these can be fixed. There are many such devices on PSP, and while NASA continues looking into this, the mission is moving forward. If needed, NASA will take more time. In addition, some guidance and control testing fell behind, but that has been addressed. Launch vehicle stage 3 issues are being worked on and should be resolved in time for the launch.

ICON testing continues, with a June launch scheduled. On the other hand, while NASA's contribution to ESA's Solar Orbiter was delivered on time, the mission is not being launched on schedule. Dr. Vassilis Angelopoulos asked about the funding impact. Ms. Luce explained that HPD has a number it can afford

and is trying to negotiate down. Congressional notification is required for certain delays and cost overruns. The Division has the funding reserves and rationales, so she does not expect problems.

The PSP Solar Probe Cup (SPC) had an issue that was analyzed, tested, and sufficiently resolved so that the instrument will be on the PSP. Operating missions are all in good shape. NASA lost contact with the Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) in February, but regained it just that morning. The Agency is emphasizing rideshares via Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter (ESPA) rings.

Geospace Dynamics Constellation (GDC) Update

Dr. Jared Leisner, Program Scientist for GDC, provided an update on the mission and its STDT. GDC is the LWS mission recommended by the 2013 DS. The STDT charge is to validate and update the science objectives, in addition to producing Design Reference Missions (DRMs). The STDT's final report should present multiple mission architectures, while also identifying science returns and tradeoffs. HPD put out a call for Letters for Application (LOAs) in 2017, receiving more than 40 responses that represented a broad range of community interests. An RFI issued in order to provide input to STDT discussions brought in 65 responses, most of which will go to the STDT; the others were either not topical or for Headquarters use only.

Dr. Cora Randall asked if those who submitted responses that are not conveyed to the STDT would be informed. Dr. Leisner said that there was no single reason why they were not conveyed, so GDC was not contacting them. In some cases, there were programmatic reasons, and opening the discussion of what is and is not conveyed constitutes a separate discussion. Dr. Dahlburg pointed out that the STDT reports to HPAC, and if the Committee is uncomfortable with the lack of reporting, they will consider it further.

Dr. Leisner explained that the STDT members were being brought on through a standard process. HPD had contacted about 20 people about becoming members, but the appointments were pending. The tentative schedule had meetings starting in May, with the final report to HPAC in spring of 2019. Constraints like the timing of appointments, availability of members, and so on, may affect the schedule. The discussions will begin by first focusing on the science questions and objectives, making the broad DS questions more specific. The STDT will then set measurement and implementation requirements, architectures, and trades. There will be in-person meetings that will be open to the public, and the schedule includes time for the STDT to consider any comments. Dr. Leisner noted that this is the first HPD STDT that is being held to Federal Advisory Committee Act (FACA) standards, which means it must be public. Other SMD divisions hold open STDT meetings.

NASA has identified some presenters and is seeking more; they will not take part in deliberations. The meetings cannot hold discussions of new instruments; any instrument discussions must be about things that have flown already. This also applies to models, ground observatories, etc. The STDT will be kept to a lower concept maturity level so that nothing is locked into a specific technology. There will be no discussion of notional instruments, only measurement requirements. The Team will not specify the mass power, either. Dr. Elliott pointed out that some requirements might be so strict that only one type of instrument can meet them. Dr. Leisner replied that if that naturally arises, it is understandable, but the STDT cannot recommend it.

For the face-to-face meetings, public comments will be emailed to him, and he will pass them along to the Team. Dr. Klimchuk said that some community members are concerned with the growth of IMAP and GDC over what was in the DS. The total cost for IMAP increased by about 25 percent, for example, which is substantial. He asked if there will be cost guidance for the GDC. Ms. Luce replied that DS cost estimates are imprecise and historically inaccurate. The reason for spending a lot of time on GDC is to determine in part if it can be done more efficiently. DSes provide a scope, but the numbers are off in all

SMD divisions. Dr. De Pontieu added that there were no new heliophysics missions in the first 5 years of this decade, so the community is concerned that the large missions will gobble up the budget again. Ms. Luce said that the priority is in the other direction.

Committee Discussion About Response to SMD R&A Charge

Dr. Michael Liemohn explained that the R&A charge was one of main topics for the meeting, and HPAC needed to formulate a response by the next afternoon. The two questions had been presented at the previous meeting. The first question addressed how SMD should handle high-risk/high-reward (HRR) research (also referred to as high-risk/high-impact). The second question concerned how SMD should manage multi-disciplinary and cross-divisional research proposals.

Dr. Matthaeus was concerned about the definition of high risk, observing that simply proposing research that has not been done is not intrinsically high risk. Dr. Liemohn replied that the presentation at the previous meeting included working definitions, in which "high risk" was defined as research that tests novel and significant hypotheses for which there is scant precedent or preliminary data or that are counter to the existing scientific consensus. Dr. Klimchuk said it seemed there were two aspects to high-risk. The first is pursuing an idea that is probably wrong but could be important if it is not wrong. The second is a methodological high risk. Mr. Darko Filipi said that it could also include science technology that has not gone through the rigorous development system, like some of the CubeSats. Dr. Liemohn agreed that the Technology Readiness Level (TRL) aspect could include some high-risk elements.

Dr. Liemohn asked each HPAC member to make brief comments about SMD and HRR. Suggestions included:

- SMD proposal solicitations should include a separate question about HRR work, and the review panels should take note of this.
- NASA should designate a level of funding for HRR.
- NASA should make clear that this is a value, and include such proposals as part of the regular review process.
- NASA should have a separate funding pool and include more senior people on the review panels.
- There should be a way to encourage young investigators, who might have more of the novel ideas.
- The ideas of precedent and consensus should not carry excessive weight, panelists should be aware of what is being done in the field, and NASA should encourage moderate risk as well as the extremes.
- There might be an extra two pages added to the standard proposal form for a separate add-on connected to the original proposal, or to write about something completely different.
- There should be a scientific final report and a lessons learned final report regardless of the success a project.
- Put 10 percent of the total SMD R&A budget in a pool, and put the HRR ideas from all four divisions together for evaluation.
- A higher approval rate would obviate the problem.
- There should be risk categories within core reviews, or separate reviews.
- The percentage for HRR proposals should not be as high as 10 percent.
- Have the panels identify proposals as high risk.
- Expand the current question about relevance to impact.
- Change the framework for how proposals are written and evaluated.
- If there is a problem, it might be a matter of the culture, so address that.
- A separate program will likely be seen as cutting into existing programs.
- Develop metrics of success.

- Have a section in the proposal for this, and let the panels judge.
- The percentage should be more like 5 or 6 percent.
- Provide clear guidance for reviewers and have them flag HRR proposals.
- The Department of Energy (DOE) allocates 5 percent for such work; it should not go above 8 percent.
- The National Institutes of Health (NIH) hold separate calls for such research, some of which are targeted to junior researchers.

Frontier Labs

Dr. Guhathakurta gave the lunch presentation, on the NASA Frontier Development Lab (FDL). FDL is a kind of incubator program that began as an ad hoc effort and grew substantially before moving into a program line structure. It includes artificial intelligence (AI) and big data in an applied AI research accelerator that combines the capabilities of NASA, universities, corporations, and other stakeholders. The SETI Institute, which searches for extraterrestrial communications, enables this public/private partnership. FDL relies on postdoctoral interdisciplinary teams that are evenly split between data science and space science.

AI involves Machine Learning (ML), data mining, and Deep Learning (DL). ML is used in modeling, similar to computational statistics, while data mining discovers patterns in large data sets and DL is an extension of ML that loosely simulates the information processing and adaptation patterns seen in biological nervous systems. Dr. Guhathakurta provided some examples to illustrate the differences. DL can identify patterns without being told what to look for, making its own distinctions. There is a "black box" element, and investigators can query the black box as to what it found. In training the computer, the volume and quality of data corresponds to accuracy. While there are some similarities to applied statistics, the process is different.

Dr. Guhathakurta described some of NASA's DL exploratory projects, which address things like tree cover, aviation data anomaly detection, and more. FDL provides a low-risk/low-cost mechanism for NASA to move forward in such areas. SETI manages the program with NASA guidance on problem definitions, while the private sector provides infrastructure, resources, and much of the funding. NASA's participation will help the Agency's strategy move forward in a more informed manner. The Big Data Task Force (BDTF) found that this type of group aligns with the recommendations that NASA have both more formal, long-term education and short-term workshops to introduce modern data science methodologies that will improve the discoveries in the vast science data archives. There are 12 projects in 7 areas being assessed for 2018, and space weather is among these. While she did not have a metric for success at hand, Dr. Guhathakurta said that results have been good. She then described a solar wind result and discussed work in the area of solar flares. Work on solar-terrestrial interactions produced an unexpected result, which shows that the machine is making unique discoveries. The keys to this effort's success are the public/private partnerships and the integration of computer and domain sciences.

High End Computing

Dr. Jeffrey Hayes provided an unscheduled update on high performance computing capabilities and High End Computing (HEC). The NASA Standard Billing Units (SBUs) for computer use have grown, but the need has expanded even more. The SBU caps within SMD reflect 2005 needs, with HPD having an allocation of 13 percent. In the previous year, the Division was allotted 44.6 million SBUs, but requests came to 88 million. HPD could buy 12 million additional SBUs for $3.5 million, which must be paid in a lump sum and renewed every 3 years. In the course of examining how else to do this, Dr. Hayes found that not all of the SBUs were used, and HPD lost half of its allocation. Some people had been turned down based on the assumption that the allocated SBUs would be utilized. Some of the non-utilization was particularly egregious. This needs to be addressed.

Dr. Matsuo said that some of the usage needs are hard to predict. For NOAA, she gets a monthly report, and the users trade units based on needs and usage. Dr. Hayes observed that this is not done systematically. There should be better estimates of HEC needs versus desires in each ROSES submission, and HPD could use an enforcement mechanism so that Principal Investigators (PIs) can swap SBUs instead of losing them. Some missions need and request SBUs, which HPD will need to analyze as well. The Division must start treating allocations like any other limited resource. Dr. Lynn Kistler wondered if this might be managed less rigidly. Dr. Hayes explained that if half of the allocations go unused, it does not make sense for NASA to buy so much computing power. The allocation needs to be used. There is no efficiency with excess; it is not scalable.

Dr. Dahlburg asked about possibilities for community self-regulation, which Dr. Matsuo thought would work, since the PIs do not want to lose the resource. Dr. Hayes said that HPD needs to do a better job of managing HEC as well. He is considering monthly reports on usage data, identification of under- and non-users, and an annual process. It is important that HPD manage this. Unlike funding, it cannot be re-phased. He bases allocations on historical usage and the size of the projects, and he only has one week during which he can make the decisions. Therefore, any swap would have to be at the grassroots level. Over-use is something he has to negotiate with each user. He has already run out for FY18. Dr. Dahlburg said that HPAC would provide feedback; they know he does a great job and would take that perspective.

Strategic Planning in HPD

Dr. Spann explained that his presentation would be broad, with some elements that might need to be addressed separately. Strategic planning aims to maximize mission cadence; assess and focus programs; and maximize research. Space weather is an emerging area. Strategic planning is also key in preparing for the next DS and the mid-term assessment. The process guides HPD in long-term planning and community engagement, while also recruiting a strong staff that reflects NASA values such as diversity and discipline balance. Preparation for the next DS involves roadmap mission studies, technology investments, and focused strategic research. NASA wants transformational technologies. To help focus the long-term vision, NASA will hold a community workshop to help with planning. In terms of community engagement, HPD needs to implement Analysis Groups (AGs), formerly Mission Operations Working Groups (MOWGs). Dr. Dahlburg noted that there was a finding on the AGs at the last HPAC meeting.

After Dr. Spann described the different types of diversity that HPD seeks, Dr. Elliott added that most of the people in the field are more experienced and senior. Heliophysics is missing a lot of the early- and mid-career scientists, and she believed the field will suffer for that. Dr. Spann agreed that this is a gap to fill. He would like to see NASA Headquarters work viewed as an opportunity to shape the community. Center capabilities management is another area requiring attention. Diversity and discipline balance is important in all positions. Dr. Larisa Goncharenko asked if there was an understanding of where the community is going and why there are so few young and mid-career people. It is a real concern, and the percentage of heliophysicists in the American Geophysical Union (AGU) is dropping. Dr. Spann said that AGU membership is a good metric. He believed that the impact of a higher R&A selection rate and the increased cadence of missions should eventually indicate a positive trend, accounting for lag time. It was not clear at which point this should be measured.

Dr. Roger Smith said that while HPD has more missions, most PIs are in areas with low selection rates. Dr. Randall added that she is reluctant to bring in too many students to heliophysics because they often lack a viable career path. She feels it might be unethical to bring them in where there are no opportunities. Dr. Goncharenko observed that Japan has a similar problem. Dr. Matsuo noted that she sees enthusiasm among students focused on data science and CubeSats. It is harder for those who want to stay in space science. Dr. Elliott cited the delay between funding increases and visibility in the community. Dr.

Dahlburg added that there are many good candidates, but no money to hire them. HPAC would consider this and come up with some recommendations.

Update on DRIVE Science Centers

Dr. Kozyra reported that she had responses to HPAC input on six DRIVE Science Center questions discussed in her previous report to the Committee. First, NASA was asked to consider O2R and Research to Operations (R2O) components and shared funding with other programs and agencies. NASA is holding off on this until there is more commitment from NOAA upper management. An enhancement option would almost require a separate pool of reviewers. The next question sought to determine the number, budget, funding profile, and lifetime of co-existing DRIVE Science Centers. The lifetime will be at least 4 years, with an optional extension. There will be more than one center at a time, and each center will be funded at no less than $2 million per year, preferably $3 million.

In researching the optimal size for high performance, Dr. Kozyra found correlations between productivity and group size. She noted that increased team size may hinder the balance of contributions. The optimal size has three key factors: level of communication; complexity of the work; and the collective intelligence. Teams exist to enhance communication and tap into collective intelligence. Collective intelligence is not strongly correlated with the intelligence of each member, but rather with their social sensitivity and sense of equality. The research further indicated that four to nine members is optimal, and six is probably best. A mitigation strategy for larger teams is to have small teams of six or seven, with the team leads meeting as a management team. In this case, the Science Center institutions would have teams of six to seven individuals, and the managers of those teams would represent their institutions in a team of teams. Depending on which organizational concepts are implemented, there could be 32 to 36 people in total.

The third question about the science centers asked about a two-phase model, and about shared resources to minimize costs and duplication between centers. The two-phase center could work given a sufficient budget, but a single-phase process removes the uncertainty of a down-selection. The fourth question dealt with site visit models and review criteria, with an annual meeting and an advisory committee among the options. Regarding the fifth question, on the computational demands of the centers, HEC support needs to increase, and there must be a center communication plan. The final question sought input on post-review awards and metrics of success. The advisory committee, ad-hoc panels, and NASA/NSF program managers will track and evaluate progress. The deliverables will depend on the individual proposals.

The DRIVE Science Center plans reflect many sources of input. Regarding teams, those who form their own team will have the benefit of familiarity. While new people bring new ideas, the communications will have to be built with them. Dr. Kozyra then reviewed the basic principles and features of the centers. The Memorandum of Understanding (MOU) between NASA and NSF is ready for signature, and the science goals and metrics need to be consistent with each agency's priorities. Funding for each center will be $1-3 million per year for 6 years, with the program ramping up to $8 million per year. Dr. Kozyra presented a draft timeline that showed the ramping up and down. Some funding could be used for guest investigators, early career investigators, supplemental funds, etc. The last 2 years will be funded at a lower level to enable ramping up of new science centers and to allow students to finish their projects. None of this is set.

Dr. Angelopoulos said that it would make sense to ramp up new centers as others ramp down, as it takes a while to get new people. Dr. Matthaeus observed that the plan sounded interesting but it was very different from programs aimed at sustaining careers. Dr. Kozyra said that the DS described the centers as answering a specific high-priority question by being focused. The primary driver is not community development; although that would almost certainly also happen. Dr. Guhathakurta wanted to know what the innovation was here. Dr. Dahlburg gave an example of a similar program with centers devoted to

answering a single question. Dr. Matthaeus added that in some cases, the centers might make major advancements but not answer the questions, some of which have been out there for decades. Dr. Kozyra said that the idea was to bring together people from different disciplines who do not normally come together. This integration of viewpoints and knowledge has been shown to increase innovation. Such a team might solve some of the outstanding science questions in the field, if the topic is focused in a manner that has high priority in each discipline represented in the team. Dr. Spann added that there will always be problems that cannot be solved in 30 years, so the centers will pick the budget and construct, and see what can be solved from within the larger question. This would still be significant. Dr. Kozyra said that another consideration is that the development of the integrated teams, themselves, in Phase 1, even if not selected for a Phase II centers, may have value in other proposal opportunities that involve science teams (for example, LWS or Theory, Modeling, and Simulations). The DS recommended a reasonable commitment by all parties, so short-term focus is not the point.

Public Comments

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

Committee Discussion and Work Session on R&A Charge

Dr. Dahlburg asked if there were any further comments on the DRIVE Centers. Dr. Matsuo asked about restrictions on what PIs can do, and on team augmentation. Dr. Kozyra said that that had not yet been decided. Dr. Smith was concerned about how members of the academic community would manage their time if they wanted to participate in a center based at another institution. Dr. Kozyra said that this was another element that required some work, as the centers do need to accommodate faculty to the extent possible. Dr. Matthaeus made the distinction between effort and funding, noting that requirements differ from one university to another. Dr. Angelopoulos observed that 9 months of teaching were unlikely to prevent someone from doing their center research. He added that HPD might as well train all six teams before making the final selection.

Dr. Kozyra said that many people believe that remote participation degrades the quality of the interdisciplinary interaction, but this field seldom has an interdisciplinary team in a single location. Failure occurs when there is no horizontal communication. The need is for a communications plan that keeps people in touch. Another thing that is still being decided is coaching. The teams are not required to be interdisciplinary. The idea was to have teams that need a center in order to function. The key is for the team to have members from the right fields for the topic. Teams may also need deep knowledge integration plans.

The benefit to society requirement comes from NSF and would be helpful but is not rigid. It is still being discussed. Dr. Klimchuk advised being clear about the intent in the AO. Dr. Spann agreed that the draft AO should be explicit. A draft release is often accompanied by a remote or virtual opportunity for input. Dr. Kozyra thought that would be helpful. The intent is to do something exciting and innovative. The goal is to fund great ideas that need specific teams. Regarding the start-up time, Ms. Luce observed that 2 years is too long for those that have the entire team in mind. Dr. Kozyra explained that they considered a planning grant. However, historically, such grants have been short on funding and time.

Dr. Liemohn next led discussion of the SMD R&A charge. He suggested that HPAC take input from all members, similar to what they had done for the first question. The second question addressed whether SMD has effective processes in place to solicit, review, and select focused, interdisciplinary, and interdivisional projects. Comments included:

- There are not a lot of interdivisional solutions. When something comes in that could go two ways, both divisions reject it, and it would be wonderful if SMD could adjust that.
- People value this but are leery of set-asides. It would be better if the funding were flexible.

- Is there a way to evaluate proposals to really compare them to discipline-specific proposals, so that the best science is funded?
- NASA has missed out on opportunities between divisions, especially with PSD.
- Specific calls could be helpful there and would be easy to do.
- Interdisciplinary science has to have an overriding reason to occur, rather than being inherently meritorious.
- At NSF, something might be proposed in one division and the manager has to take it to the other divisions.
- It would not be a good idea to set up funds specifically for this work.
- In addition to heliophysicists, scientists from planetary and astrophysics largely feel that interdisciplinary work is not being done and that the funding is the major barrier.
- If you want to model certain areas of ICON, there is no place to go to link. The Fermi mission could be helpful in solar flares research, but it is based in another division and there is no clear place to submit a proposal.
- SMD should support a community that develops good ideas and knows how to seek funds.
- There should be real funding in order for collaborations to work.
- There should be acknowledgement that some other group might want to evaluate a particular data set.
- A dropdown box on the website for proposal submission would help visibility.
- SMD needs to look at the boundaries.
- There are differences in methodologies that can constitute another aspect of interdisciplinary work. Fluid mechanics is an example.
- A discipline that is defined narrowly can end up with other kinds of restrictions.
- It is hard to fund scientists who are not strictly in one's area.
- Technologies and robotics would benefit from collaborations.
- The interdisciplinary proposals are hard to get validated, as both sides will see parts of the proposal as strange.
- There is a lot of synergy between astrophysics and heliophysics.
- LWS showed that a targeted opportunity works well.
- There is a need for panels that can address the interdisciplinary proposals.
- There may be a need for an SMD set-aside.
- The DRIVE Science Centers could provide a real opportunity.
- This works best when people from different disciplines are interested in working together.
- Many heliophysicists cross over to the other areas, and HPD needs to recognize that.
- The interdisciplinary and science boundaries are where a lot of discoveries come from, and SMD should enable that. One way is for SMD to have an ongoing call for interdisciplinary research.
- It can be hard to know whether to go to a certain division, and not all of the review panelists will understand what the proposer is trying to say.

Ms. Luce said that she has been perplexed by the fact that the HPD Guest Investigator (GI) program is only open to heliophysics missions. It seems short-sighted. Dr. Dahlburg said that it can be hard to convince people that they can step outside of division boundaries. Dr. Elliott said that if proposed work makes a significant contribution to the mission, that could be an evaluation criterion. Dr. Smith added that making progress on the original objectives of the mission should be considered as well. Dr. Kozyra explained that review panelists for interdisciplinary projects can be reluctant to fund something that is commonplace for their own discipline, even when that element is key to an innovation in another discipline. They are seeking cutting-edge science from their own perspectives.

Dr. Guhathakurta said that it might be interesting to determine if there is a website or other place to pose questions that are interdivisional and interdisciplinary. Dr. Dahlburg liked that idea. Dr. Matthaeus suggested having the existing panels pass interdisciplinary or interdivisional proposals up to SMD, which could convene a special panel to evaluate them. Dr. Dahlburg said that another possibility would be a place for short white papers. Dr. Kozyra explained that the University of Michigan has a program in which investigators post their interdisciplinary ideas in order to find others who share the interest. Dr. Elliott noted that NASA has the Office of the Chief Technologist (OCT) for cross-cutting technologies. Dr. Smith did not believe there were currently opportunities to propose interdisciplinary or interdivisional research, so that needs to be made explicit in the AOs. He also did not think they should assume that there were a lot of these proposals ready to submit.

Dr. Liemohn repeated the SMD R&A definitions of "multidisciplinary", "interdisciplinary", and "interdivisional." HPAC was free to provide its own definitions, however. As HPAC assigned responsibility for the sub-bullets within the two SMD questions, Dr. Angelopoulos said that a "go slow and adjust" approach would be the best answer in some cases. Dr. Kozyra observed that in HPD, the program officers talk to each other and are amicable, but there is still a boundary. Dr. Michael New, SMD R&A Director, gave some examples of trades between divisions. Dr. De Pontieu said that each review panel includes experts from a different subdiscipline, and they might each have different success rates. Dr. Randall added that an expert in a particular discipline is not going to give a high ranking to something on the edge. Dr. Smith pointed out that the only place that deals with the full range of heliophysics disciplines is the SR. There was discussion of passing multidisciplinary and multidivisional proposals (aka "homeless" proposals) to SMD for special panels. There was concern that even these might not be enough, and might require augmentation with mail-in reviews. Dr. Kozyra explained that research on peer review shows that mail-ins are looked at inconsistently. They have the least influence on changing the grade and are mostly used for confirmation. It also lowers the reviewer pool. Dr. Goncharenko added that the same proposal can get very different marks from different panels, because individuals react differently. Dr. Spann noted that panel reviews have coverage limitations, but NASA encourages full panel discussions and works to address this robustly.

In other discussion, Dr. Dahlburg said that there was some discomfort with Dr. Leisner stating that the rejected RFI submitters would not be notified. Dr. Randall agreed to write something for that, and Dr. De Pontieu was to respond to Dr. Hayes' report. There were still questions about the H-SR and Guest Investigator proposal calls, which still have low success rates. Several HPAC members agreed to develop a description of the additional information the Committee would like at the next meeting. Dr. Kistler volunteered to write a paragraph identifying the issues with the SMEX cadence and the next AO.

Ms. Luce thanked the HPAC members for being so engaged and helpful. She was unable to appear at the next day's outbriefing in person, but promised to call in for it.

Adjourn

The meeting was adjourned for the day at 5:02 p.m.

Friday, April 6

Opening Remarks, Announcements

Dr. Dahlburg reviewed the agenda for the day. Dr. Liemohn said that he was assembling the responses to the SMD R&A charge.

Status of Lunar Orbiting Platform – Gateway

Dr. Spann described NASA's exploration plans as they existed prior to the inception of the Space Council. These plans had the goal of human exploration of Mars, but the phases still apply to the new emphasis on a return to human exploration of the moon. Phase 1 will focus on leaving Low-Earth Orbit (LEO) and beginning missions in cis-lunar space. The Lunar Gateway (LG) is a platform that forms the foundation of Phase 2, and will enable human exploration. Dr. Spann wanted to discuss the possibilities for heliophysics involvement in Phase 1. Four areas drive the LG effort: human exploration operations and techniques, technology demonstrations, characterization of human health and performance, and high-priority science.

Dr. Spann outlined the steps in the gateway process through about 2026, noting that it was conceptual. Various orbits are being considered for the LG, some elliptical and others more circular. The propulsion capabilities under consideration should allow it to change orbits as needed. The LG will not have a crew most of the time. In order to understand the science payloads that could be done on the LG, NASA held a Deep Space Gateway (DSG) workshop across all of the science disciplines, with some engineering input. The workshop goal was to determine the science and related technology development areas that might feed into LG planning. A heliophysics subgroup submitted abstracts, organized sessions, etc., in order to examine the science and research that might be achieved, the knowledge gaps that might be filled, and the science and research that could be jointly relevant to human exploration and science.

The meeting had more than 300 attendees and produced 180 abstracts covering 12 topics. There were 33 abstracts focused on heliophysics, as well as 38 related presentations over 4 sessions. Aside from planetary, heliophysics was the best represented group present. The heliophysics field feels a bit of ownership in helping human exploration, and this platform will enable a lot of that. For example, many of the presentations were on space weather and radiation. There was also some cross-over between life science and radiation. The largest session focused on external payloads and emphasized DS science with a sun-pointing platform, an Earth-pointing platform, and an in situ instrument suite. The International Space Station (ISS) already has an Earth-pointing platform, and there has been talk of having a solar-pointing platform. This is more the intermediate step between sounding rockets and a full mission.

Another cross-disciplinary discussion addressed dust, small particles, and dusty plasmas. There was discussion of dust collectors or detectors that could be on the platform, possibly to be brought back to Earth. Certain instruments will be in place anyway, such as dust monitors and radiation monitors, and they might as well be science-grade. Those conversations are ongoing. The space weather session discussed radiation observations, which need to be developed for astronauts to use in deep space so that they can forecast rapidly evolving space weather situations. CubeSats and smallsats were the subject of another session. The LG could provide staging and deployment of small spacecraft to form a radio telescope network, for example, as well as space weather ensembles. There were also thoughts of measuring solar wind in a lunar orbit.

In summary, the heliophysics community has strong interest in the LG, and has unique perspectives on geospace. The LG will facilitate development space weather observatories that cannot rely on an Earth connection, also staging prototypes and multi-spacecraft mission concepts while presenting a unique deployment stage for some missions. The next steps are to coordinate the heliophysics community input to the DSG workshop and to document that input in the form of a report. SMD is discussing next steps with the Human Exploration and Operations Mission Directorate (HEOMD). HEOMD may want a quick return, but it could be possible to conduct some science in the early stages of construction. Items like radiation monitors would be easy, while a telescope might be more complex. This has been presented to the Space Council, which is considering the workshop input.

Status of Space Weather Effort

Dr. Terry Onsager explained that the goal of NASA's space weather effort is to provide information that enables economically important decisions. He described a NOAA Space Weather Prediction Center subscription service that has a wide range of commercial, government, and international customers. This service has grown tremendously and steadily. The Senate passed a Space Weather Research and Forecasting Act in the previous year; no action had yet been taken in the House, though it was still possible that the House would take up the bill before the next Congress, when it would need to be reintroduced.

The National Space Weather Strategy and Action Plan involves 20 government departments, agencies, and service branches. The White House is reworking the Plan's six goals and will release a new set soon, probably in the summer. The current action plan is broad and focused on electric power as a key risk area. The revised plan will focus more on general space activities. Dr. Onsager then highlighted areas in which NASA has a key role. These include goals in the area of benchmarking, where NASA leads the ionizing radiation area. The Phase 1 documents on this will be released soon. Goal 4 involves impacts on critical infrastructure, for which there is an economic impact study. Industry has a strong interest in this area and wants to work with NASA in forecasting and mitigation. It was noted that military interests are engaged in these efforts but have their own activities.

Goal 5 is about improving services through advancing understanding, and NASA is working closely with NOAA and NSF on this. Dr. Onsager reviewed a number of activities in the broad area of making sure the United States has the observing systems it needs. NOAA is doing an architecture study to determine the best configuration of platforms to obtain key observations. This area has opportunities for commercial partnerships. In addition, a number of international organizations, including the United Nations, are engaged in space weather services. It is here where the heliophysics research has exciting partnership opportunities with NOAA and NSF. In moving from basic to applied research opportunities, one of the challenges is to ensure that the needed elements come together to connect the desired applications. The 2017 O2R call was funded, and a 2018 effort could be multi-year. One task for a CCMC - Space Weather Prediction Center (SWPC) collaboration has been initiated. While there will be related ROSES calls, CCMC-SWPC is an interagency effort, and there is no plan for specific research calls. Dr. Spann said that the O2R can feed into CCMC-SWPC activities. Dr. Onsager explained that these are all linked very tightly, but there is an interagency effort in addition to the broad, community effort.

Dr. Liemohn observed that the recent call was very focused and targeted, which Dr. Onsager said reflected the applied research element. The science centers will focus primarily on a research topic, and if a particular piece could get an augmentation, it could fit well here. Dr. Matsuo said that she could see that this has to be targeted, then described a NOAA funding situation that works in reverse of NASA's request that the community propose. To be useful in O2R, the source code, etc., has to be completely open, which all needs to be clarified for this to go forward. Dr. Onsager said that this is an important issue that is being discussed. Dr. Guhathakurta pointed out that there are commercial entities taking NASA's open source models and making them private. This needs to be discussed.

Dr. Goncharenko added that while the community is interested, scientists are inhibited by having to fund themselves. Dr. Onsager agreed that this is important and needs to be addressed. Dr. Dahlburg pointed out that in both contract and grant funding, there are differences in the way NASA takes ownership of models. She wondered how HPAC might help and wondered if the open source model needs to be refined. Dr. Onsager replied that there are different types of open source, and NASA needs to explore that. Dr. Dahlburg asked who would provide guidance to the community on that. Dr. Spann said that HPD is looking at a science-to-applications program to address and codify these issues, considering how some of the Earth science groups manage this. The general approach is iterative and there may be a separate program element that could pay people, like Dr. Goncharenko implied. The new science-to-applications program will lay out some rules of the road. HPD wants to address the problem through a program, not

through a center, to focus and enable research to move into applications. Dr. Matsuo said that it has to be a community model that is specific, while also being open so the community can accept and trust it. Dr. Dahlburg said that terrestrial weather applications are accepted because there are a few well-known models. It is impossible to have just one model, but too many would be problematic. Dr. Matsuo noted that there are also national models, which present intellectual property issues. Dr. Onsager said that some aspects of terrestrial weather applications would work well in the space weather area, but there is a big difference in the maturity of the fields. Society is in the early stages of how to deal with space science and space weather, and there are many contributors. It is exciting that significant progress is occurring, but there are many challenges. The workforce for this is the solar/terrestrial science community, and there is a need to foster the evolution. Dr. Klimchuk said that the national security community is more interested in photons, and he wondered if the difference in emphasis is healthy. Dr. Onsager said that there are needs across all of these areas. The space weather effort should focus on progressing where people need the information most. Dr. Dahlburg said that HPAC would ask for an update at the next meeting.

Committee Discussion and Work Session

Dr. Liemohn resumed reviewing the responses to the SMD R&A charge. On the question of HPAC's definitions of high-impact and high-risk, Dr. Kistler wrote two versions of a response. The Committee preferred the response stating that this is research with a low probability of success but whose outcome, if confirmed, would have a significant impact on thinking, methods, or practice. The research may be counter to the existing consensus, and therefore lack supporting information or have an unestablished methodology, but it is clearly not false and so merits serious examination. In responding to a question about how the review process might more effectively elicit and support such projects, Dr. Klimchuk presented specific ideas that might help SMD develop a procedure. Dr. Ho noted that PSD proposers must specify the impacts and outcomes of such research. Dr. Liemohn said that he would wordsmith this and the other responses.

Next, Mr. Filipi wrote about the design of solicitation or evaluations methods for HRR research. This topic generated quite a bit of discussion. Mr. Filipi's draft included suggestions for a separate call, leveraging of contracts, partnerships with the private sector, and multi-phase procurement. A couple of HPAC members saw this as too specific or too oriented to technology. Dr. Matsuo preferred the suggestions for focused calls and a two-step process; NSF does the latter. Dr. Randall wanted the option to change the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) so that calls could be flagged. Dr. Klimchuk recounted a small program he ran that relied on having some senior people pulled from outside NSPIRES, but there were objections that such a panel might lack the needed diversity. Dr. Kozyra added that research on panels shows that reviewers with expertise most closely aligned with particular research topic tend to be the harshest in their criticisms. There was also concern that proposers might try to cast their research as HRR through the use of buzz words. Dr. Smith said that they were talking about a small funding pool, and there was no greater likelihood of such proposals being funded. Dr. Liemohn said he would add that this could be done within the process itself, and note the issues identified.

Dr. Cassak wrote the draft response about how SMD might determine the right balance between moderate- and high-risk research, stating that the National Academy of Sciences (NAS) recommends an 8 percent minimum for high-risk research and DOE has a 5.5 percent allocation. HPAC recommended about 5 percent across all of SMD, rather than by individual divisions. There was general agreement with an alternative suggestion, that a portion of the funding for this research stay in the divisions and a portion be directorate-wide. Dr. Kozyra said that NSF has program officers identify HRR research, but they never hit the 5 percent goal because the program officers tend to be conservative.

Dr. Liemohn presented further thoughts on the solicitation design and evaluation methods question, recommending that funded HRR research projects provide a final report that includes lessons learned, in

order to document what happens regardless of success or failure. These reports should be made public so that others can learn. These would be NASA reports rather than peer-reviewed papers. HPAC members agreed that they did not want to recommend a funding cap on such proposals, preferring a percentage. They also agreed that duration should be left open. Dr. Liemohn said that he would revise the drafts and circulate them to HPAC members for comment.

The first sub-bullet on the interdisciplinary/interdivisional question asked about balance between division-specific and interdivisional research. Dr. Angelopoulos wrote a recommendation that SMD "go slow and adjust" so that NASA and the community can test and augment any solutions. There was discussion about whether to specify a percentage, but the issue was not resolved. There were also concerns about HPD getting its contribution back, how to determine the right balance, proposal quality, and how specific HPAC's recommendation should be. The Committee came back to this later.

Regarding processes to achieve this balance, Dr. Matthaeus recommended cross-divisional panels. Dr. Randall added that the program managers need to be involved. Dr. De Pontieu said that taking these proposals to a single division would lead to rejections because the panelists might not see the benefit. For example, a proposal may have elements that are standard for heliophysics but innovative for planetary science. Dr. Angelopoulos thought that the proposers should be cued to the fact that these are cross-divisional. He advocated a separate call. Dr. Liemohn was concerned about the differences between a regular call with a proposal on the boundaries and having a separate panel. Dr. Angelopoulos did not think SMD could easily accommodate both. Dr. Liemohn said that there should be a pulldown option so that proposers can choose their category.

Dr. Dahlburg shifted to reviewing the outbrief to Ms. Luce, which began by thanking all of the participants, then acknowledging Ms. Luce's presentation. HPAC would like a focused talk about DRIVE at the next meeting. Some R&A success rates remain low, affecting support for the future of the field, and it would be useful to get funding information on all of the programs since DRIVE was implemented. HPAC was pleased to hear about the Mid-EX AO but was concerned that it and the SMEX were so close. A delay of 6 months would keep HPD within the cadence. HPAC also wants information about the responses to the GDC RFI. Specifically, the Committee wants to know that the unsuccessful RFI responders will be contacted. Regarding the R&A charge from SMD, HPAC discussed the questions and sub-bullets, and developed definitions.

HPAC heard about HEC from Dr. Hayes, who has provided outstanding HEC support. Since HEC is in high demand, HPAC appreciates the HPD investment in additional SBUs. Because of the underutilization issue Dr. Hayes identified, the Committee recommended that HPD examine practices at other high-use organizations, along with usage monitoring and ways to enable reallocation. Given the oversubscription, HPAC thought the review process should take into account the balance in the program. There was discussion about whether to have an enforced or voluntary program. It was noted that the over-allocation is across SMD. Dr. Dahlburg said that this was also not a deep analysis. She suggested that the outbrief state that HPAC would like to address it further. As suggested by Mr. Filipi, Dr. De Pontieu said that the recommendation is to see how other organizations, including other SMD divisions, handle this. The issue of voluntary versus enforced programs could be discussed in the future.

Dr. Dahlburg resumed the draft outbrief review, noting the presentations on strategic planning, the DRIVE science centers, and the LG. Following the space weather presentation, HPAC agreed that there are issues to be addressed in both the community and the Agency. One such issue is intellectual property. In addition, the strategic planning process should encompass human resources. Dr. Angelopoulos said that for the Mid-Ex portion of the briefing, he wanted to add that a short delay would be worthwhile in terms of both synergy with the SMEX and the evolutionary aspect. Others agreed, and Dr.

Angelopoulos's report was to list advantages and disadvantages. Dr. Spann cautioned about scenarios in which HPD might lose the funding.

Discussion returned to the report on the SMD R&A charge. For the question about how divisions determine the right balance between discipline-focused and interdisciplinary research, Dr. Smith said that announcements should have an additional statement welcoming interdisciplinary proposals that will be evaluated by a panel. It was suggested that HPAC state a preference to have an initial 5 percent of the budget dedicated to this purpose for both interdivisional and heliophysics interdisciplinary proposals. The latter mattered, as heliophysics panels are organized to be very specific. Dr. Angelopoulos pointed out that the discussion of interdisciplinary research originated from the fact that people propose very narrowly due to the fact that they are penalized on the details when they go broader. This was just a recommendation to SMD on how to interject interdisciplinarity where there was none. Dr. Ho was concerned about the percentages chipping away at programs. Dr. Randall thought it would be better to just encourage these proposals in the AO, and Dr. Matsuo was worried about fair evaluation. One suggestion was to add a pull-down menu. Ultimately, it was agreed to state that HPAC disagreed about whether or not there should be a guideline.

Drs. Randall and Ho wrote about whether SMD is missing important research due to its solicitation, review, and selection processes, and what changes might address the situation. They stated that SMD neglects important work because of the lack of support in these areas, and gave examples. Possible strategies included targeted solicitations and flagging such proposals in the standard solicitations. Dr. Matthaeus observed that panels seem to look for rejection criteria rather than acceptance criteria. Dr. Kozyra noted that HPD had decided to defer a larger discussion about R&A to a later meeting; she would take this input and would take additional, individual comments from HPAC members.

Dr. Elliott addressed the questions about how to modify solicitations and evaluation methods for interdisciplinary and interdivisional work, and the role of collaborative research structures within SMD. She recommended that announcements specify that interdisciplinary and interdivisional research is allowed, and that NSPIRES offer a dropdown menu. The latter would also aid in panel construction. She pointed out that collaborative research is being done for DRIVE. Dr. Dahlburg noted the popularity of the Nexus for Exoplanet System Science (NExSS), which is not expensive. It is important to have an outreach person for such efforts. There was discussion about the relative success of, and heliophysics involvement in, some of these collaborations. Dr. Liemohn said he would add that HPAC needs more information on how well these work.

HPAC Outbrief to HPD Director

Dr. Dahlburg presented the outbrief to Ms. Luce, making the points discussed above and having other HPAC members report on specific topics. In describing HPAC's concerns about the Mid-EX and SMEX AOs, Dr. Kistler emphasized that having the two solicitations so close together would be a burden for proposers. Dr. Dahlburg then noted Dr. Leisner's presentation and HPAC's recommendation about contacting the RFI respondents who were not selected. Next, Dr. Liemohn reviewed the responses to the SMD R&A charge. He noted that HPAC was split on having separate or regular ROSES calls for interdivisional and interdisciplinary proposals.

Dr. De Pontieu recapped the discussion about HEC underutilization. HPAC recommended that HPD inform the community of the consequences of underutilization, in addition to monitoring usage and considering the practices of other organizations. There were varying views on having a program in which users could trade unused SBUs. Any imposed program should not be overly punitive, and any voluntary program should have incentives. HPAC wants to hear how other SMD divisions manage this resource. Dr. Dahlburg continued the outbriefing as planned during the HPAC discussion. She noted that there is

concern about intellectual property issues related to space weather efforts, and these issues should be addressed.

Ms. Luce thanked HPAC, stating that these were thoughtful and helpful findings and recommendations. She added that HPD staff form a strong and supportive team, as demonstrated by the presenters and those who work with them. HPAC is part of the team, with constructive interactions and full engagement. HPD will look at the R&A success rate, but her inclination is to enhance the lower-performing areas without taking funds from the more successful areas. She will put together the data for discussion at the next meeting. The decision about the Mid-EX AO would be made soon so that people can plan ahead. She was interested in seeing how SMD will respond to the R&A charge input. HPD will look at the suggestions on how to manage HEC. She thanked Drs. Kozyra, Spann, and Onsager for their presentations and input. Dr. Spann added that he appreciated how well HPAC worked, noting that their input was especially helpful with space weather and the science centers.

Adjourn

The meeting was adjourned at 1:30 p.m.

Appendix A
Attendees

Heliophysics Advisory Committee Members
Jill P. Dahlburg, Naval Research Laboratory, Chair
Vassilis Angelopoulos, UCLA
Paul Cassak, West Virginia University, *via telephone*
Bart De Pontieu, Lockheed Martin
Heather A. Elliott, Southwest Research Institute
Darko Filipi, Adcole Maryland Aerospace
Larisa Goncharenko, MIT Haystack Observatory
George Ho, Applied Physics Lab
Lynn Kistler, University of New Hampshire
James Klimchuk, NASA Goddard Space Flight Center
Michael W. Liemohn, University of Michigan
Tomoko Matsuo, University of Colorado at Boulder
William Matthaeus, University of Delaware
Mari Paz Miralles, Harvard-Smithsonian Center for Astrophysics
Cora Randall, University of Colorado at Boulder
Roger W. Smith, University of Alaska (via telecon)
Janet Kozyra, NASA HQ, *Executive Secretary*

NASA Attendees
Jennifer Abalt
Ralph Beaty
Galen Fowler
Lika Guhathakurta
Roshanak Hakimzadeh
Jeffrey Hayes
Jared Leisner
Ms. Luce, Acting HPD Director
Jeff Morrill
J. Daniel Moses
Michael New
Terry Onsager
Jim Spann
Nicole Turner
Alan Zide

Other Attendees
Lamont DiBiasi, Southwest Research Inst.
Heather Futrell, Booz Allen
Sam Haine, Booz Allen
Grace Hu, OMB
Elizabeth Sheeley, Zantech
Ashley Wilkins, AAS

Remote Attendees

Abtin Forghani Aghdam
Stephen Clark
Christine Cohen
Jeff Foust
Ben Kallen
Erin Kennedy
Mona Kessel
James Lochner
Ryan McGranaghan
Vanessa Patrick
Kristin Shahady

Appendix B
Advisory Committee Membership

Jill P. Dahlburg, Chair
Naval Research laboratory

Janet Kozyra (Executive Secretary)
NASA HQ

Vassilis Angelopoulos
UCLA

Paul Cassak
West Virginia University

Bart W. De Pontieu
Lockheed Martin

Heather Elliott
Southwest Research Institute

Darko Filipi
Adcole Maryland Aerospace

Larisa Goncharenko
MIT Haystack Observatory

George Ho
Applied Physics Lab

Lynn Kistler
University of New Hampshire

James Klimchuk
NASA Goddard Space Flight Center

Michael W. Liemohn
University of Michigan

Tomoko Matsuo
University of Colorado at Boulder

William Matthaeus
University of Delaware

Mari Paz Miralles
Harvard-Smithsonian Center for Astrophysics

Cora Randall
University of Colorado at Boulder

Roger Wilford Smith
University of Alaska – Fairbanks

Appendix C
Presentations

1. *Heliophysics Division Overview*, Peg Luce
2. *Geospace Dynamics Constellation (GDC) Science and Technology Definition Team (STDT) Update*, Jared Leisner
3. *NASA FDL Overview*, Lika Guhathakurta
4. *Heliophysics Strategic Planning*, Jim Spann
5. *Update on DRIVE Centers Program,* Janet Kozyra
6. *Heliophysics Science and the Lunar Orbital Platform-Gateway*, Jim Spann
7. *Status of Space Weather Effort*, Terry Onsager

Appendix D
Agenda

Heliophysics Advisory Committee (HPAC) Meeting
NASA Headquarters, Washington, DC
April 5-6, 2018

Thursday, April 5, Room 3H42 (MIC3-A)		
9:00	Welcome, Overview of Agenda	Jill Dahlburg, HPAC Chair
9:15	Heliophysics Division Overview & News	Peg Luce, NASA HQ
10:15	Discussion About Implications of Flat Out-Year Budgets for the DRIVE Initiative	Peg Luce, NASA HQ
10:30	**BREAK**	
10:45	Geospa ce Dynamics Constellation (GDC) Update	Jared Leisner, NASA HQ
11:15	Committee Discussion About Response to SMD R&A Charge	Mike Liemohn, Jim Klimchuk, Paul Cassak
12:00	**LUNCH –** Presentation on Frontier Labs	Lika Guhathakurta, NASA HQ (on detail at Ames)
13:00	Strategic Planning in HPD	Jim Spann, NASA HQ
14:00	**BREAK**	
14:15	Update on DRIVE Science Centers	Janet Kozyra, NASA HQ
14:45	Public Comments	
14:55	Committee Discussion and Work Session on R&A Charge	
17:00	ADJOURN	

Friday, April 6, Room 3H42 (MIC3-A)		
9:00	Opening Remarks, Announcements	Jill Dahlburg, HPAC Chair

9:10 Status of Lunar Orbiting Platform - Gateway Jim Spann, NASA HQ

9:40	Status of Space Weather Effort	Terry Onsager, NASA HQ
10:10	**BREAK**	
10:20	Committee Discussion and Work Session	
12:00	**Lunch** and Continuation of Committee Work Session	
13:00	HPAC Outbrief to HPD Director	
13:45	ADJOURN	