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Dr. Paul Hertz
Astrophysics Director
Science Missions Directorate
National Aeronautics and Space Administration (NASA)

Dear Paul,

The NASA Astrophysics Advisory Committee (APAC) had its Spring meeting on 2021 March 15-17. Due to the continuing COVID19 environment and related NASA operational and travel restrictions, the entire three-days of the meeting where conducted virtually using WebEx^{tm} videoconferencing technology accompanied by digital portal and chat-window related means to assist in exchanging comments. The following members of the APAC attended the meeting: Manuel Batista, Kelly Holley-Bockelman (Vice Chair), Jessica Gaskin, Hashima Hasan (APAC Executive Secretary), Ryan Hickox, Lou Strolger, Suvrath Mahadevan, Margaret Meixner, Michael Meyer, Lucianne Walkowicz, and Chick Woodward (APAC Chair).

Each day, Dr. Hasan began the meeting by welcoming all the APAC members, and explaining the committee's purpose. Dr. Hasan reminded APAC members who had conflicts of interest with specific topics on the agenda were allowed to listen to the presentation but could not participate in the committee's discussion as they are conflicted. Dr. Hasan then reviewed the Federal Advisory Committee Act (FACA) rules. Dr. Woodward then welcomed the members to the meeting, outlined the agenda, and reiterated some of the FACA and conflict of interest rules. APAC members proceeded to introduce themselves.

The APAC thanks all the presenters for their time and efforts to provide crisp and informative presentations. In addition to the agenda, the presentations for the meeting are also posted at https://science.nasa.gov/researchers/nac/science-advisory-committees/apac

The APAC also appreciated the free-wheeling conversation with the Science Mission Directorate (SMD) Director, Dr. Thomas Zurbuchen, on day 2 (16 March 2021). This discussion centered around evolving SMD strategic science vision, attention to BIPOC and status of the profession issues, and how SMD and NASA can drive technology innovation and mission opportunities working with commercial partners and other stakeholders. The APAC and the SMD Director also exchanged views on how NASA and the community rely on the decadal process for providing roadmaps to push science frontiers and means for effective stewardship of priorities.

The third day of the meeting, 17 March 2021, was primarily dedicated to a review of SMD and the Astrophysics Division (APD) actions and initiatives, in part a response to prior APAC

findings and recommendations regarding NASA workforce challenges. It is the APACs specific intent to continue these discussions as part of the regular meeting agenda.

The brevity of the APAC's report and recommendations are largely due to strategic and programmatic uncertainties as the committee and APD await recommendations from the forthcoming the 2020 Astronomy and Astrophysics Decadal Survey release.

The APAC ("the committee") has the following findings and recommendations as a result of the presentations and subsequent discussions.

STATE OF THE PROFESSION

The APAC is pleased that the APD, with support from SMD, continues to lead conversations and internal action-group efforts to identify barriers to diverse workforce participation in NASA activities and to remedy impediments to success posed by structural racism. The APAC is pleased that NASA is utilizing external experts to help them with this work. The APAC agreed that it is important to recognize that transformative work on diversity, equity, and inclusion requires dedicated and continual attention to these issue that had been previously directed elsewhere. The APAC concurs that DEI work should be recognized and highly valued as the 5th pillar of NASA.

Findings

APD is taking a leadership role within SMD in transforming the internal workforce, panel review, and proposal evaluation process. The APAC applauds these efforts, noting that the diversity, equity, and inclusion work piloted in APD will be a useful resource for the Directorate.

Recommendations

The APAC requests continued updates on DEI initiatives in APD, in particular on the DAPR process and the addition of an inclusion plan for ATP proposals, as well as the status of actions under consideration, such as externships, research initiation award models, and mentee feedback during project reports.

The APAC requests that APD consider adding language to the DAPR process that encourages proposing teams to acknowledge their intent to follow ethical research best practices and to confirm that key members of their team are not encumbered by known (best available public knowledge) incidents that violate community-accepted codes of professional conduct.

The APAC requests that all mission updates at future APAC meetings contain updates on leadership demographics and efforts to support the 5th NASA pillar.

ASTROPHYSICS DIVISION (APD) UPDATE

The committee was briefed on how APD has developed successful mitigation strategies to whenever possible maintain the cadence of AOs and review of proposal in the COVID19

environments. The APD successfully delivered to the community proposal solicitation opportunities without large scale interruption throughout the COVID19 pandemic era, successfully completing reviews, making selections, and releasing funding with a near normal cadence. The APD team's efforts in maintaining continuity is highly appreciated by the astronomical community.

Specifically, the committee discussed with the success of the virtual review environment. Implementation of the model enhanced the Division's ability to attract a more diverse reviewer pool, and while not inhibiting timely review process completion and PI notification consistent with established APD benchmark metrics. There was little compromise in review quality. Clearly one down-side of the virtual interaction is the lack of networking experiences that in-person review activities foster. However, the virtual review environment model or hybrid thereof may have value-add potential for the APD in the future, potentially lowering division cost, scheduling difficulties, and carbon-footprint.

The committee also discussed how DAPR is changing community culture and providing for more equitable evaluation of science ideas. DAPR is having a positive effect on the proposal evaluation cycle and the APAC is pleased that APD is rapidly moving to expand this process to all appropriate AOs in the portfolio.

The APAC was reassured that Astrophysics payloads can be part of the Artemis campaign, leveraging from the infrastructure. Likely, the upcoming astrophysics decadal survey will identify appropriate opportunities.

The APD conveyed to the committee that it is poised rapidly to act on the 2020 Decadal Survey recommendations upon release, and the division has strategically reviewed current budget commitments to provide initial flexibility in anticipation of decade priorities.

Findings

The APAC welcomes the addition of inclusion as a core value of the NASA Science Mission Directorate.

The APAC finds that the APD is responding in a responsible manner to provide assistance for early-career researchers and other investigators on existing grants affected by the COVID19 pandemic.

Recommendations

The APAC requests the APD present an overview of their initial response to the 2020 Decadal Survey priorities of missions and portfolio balance at its 2021 June meeting, if the report is issued in time for this request to be practical.

The APAC request an update on the Sci Act 2.0 following the implementation of recommendations from its recent review at its 2021 October meeting.

The APD should critically review the virtual review environment for value-add and report out to the APAC their conclusions of whether such arrangements offer benefits.

The APAC requests two selected 2020 Pioneer mission presentations at its 2021 June meeting and two at the committee's fall 2021 October meeting.

SOFIA UPDATE

The APAC applauds recent efforts to improve the scientific productivity of SOFIA. It appears that the new instrumentation roadmap makes sense and that the Project has been responsive to requested improvements in efficiency. The committee notes that only the first element of the instrumentation roadmap is funded through the SOFIA budget and that future new instrumentation is not yet funded.

SOFIA also has made a pivot towards a more effective utilization of archive products and broader investigator flight opportunities to yield better cost per dollar on investment as the Project commences its extended mission.

Findings

SOFIA has responded aggressively with a plan to increase science productivity.

Recommendations

The SOFIA Project and SOFIA Mission Office should track developments of the ASTHROS balloon effort to look for scientific and collaborative synergies.

The APAC encourages SOFIA to continue to pursue alternative deployment sites to enhance flight opportunities for the community.

The APAC requests an update on the instrument roadmap schedule and funding mechanisms at the 2021 October meeting of the committee.

IXPE UPDATE

The APAC has no concerns with IXPE.

Findings

IXPE is making excellent progress toward launch and the development of machine learning techniques to improve polarization measurements is promising.

Recommendations

The APAC requests an update on early IXPE science at a future meeting.

CUTE UPDATE

The APAC thanks Kevin France for the informative presentation on CUTE, a soon-to-be-launched 6U CubeSat to study near-ultraviolet stellar emission and absorption caused by mass loss from a short period highly irradiated planet. Although only 1 to 2 dozen targets will be observed, primarily well-known giant planets around bright FGK and A stars, the project promises exciting results in the next 1 to 2 years. In particular the committee was pleased to hear that publicly available data will be made available through the NASA Exoplanet Science Center perhaps as early as mid-2022.

As part of a broader APAC conversation of the CubeSat program, the committee discussed the merits of ADP providing an inventory of technical readiness level (TRL) 9 CubeSat platforms to assist proposing teams' build schedules and to reduce development risk through deployment of common architectures. NASA is not planning to procure CubeSats in advance, but the Small Spacecraft Virtual Institute provides a good avenue to transfer knowledge about smallsats. The APAC is pleased that an inventory is available at a NASA hosted URL.

The APAC agrees that the CubeSat and Pioneers programs are demonstrating their importance to the overall APD portfolio as community on-ramps for exciting science, workforce training opportunities, and innovation with risk requirements that are flexible. These programs are likely growth wedges for community science.

Findings

The majority of CubeSat PIs thus far have had experience in sounding rockets or balloons.

BALLOON ROADMAP UPDATE

A Roadmap for Scientific Ballooning: 2020-2030 was developed by the Balloon Roadmap Program Analysis Group that was submitted for consideration in the 2020 Astrophysics Decadal Survey. Terms of Reference and the Program Analysis Group final report are at: https://sites.wff.nasa.gov/code820/roadmap_pag.html. An overview of the roadmap was presented. The roadmap identified key science drivers (Astrophysics, Earth Science, Planetary Science, and Solar and Space Physics) and needed capabilities for NASA's Balloon Program, maturing strategic technologies for achieving this science, evaluated Balloon Program goals, objectives, and investigations related to the larger ballooning community, identified focus areas for balloon technologies, and assessed balloon launch opportunities and mission capabilities by commercial providers. Findings indicated that improvements in capabilities in the areas of Super-pressure Balloons, telemetry, lift, pointing, large aperture telescopes, opportunities for small payloads, and commercial opportunities for Aerostats would have a large benefit to the science community. More opportunities for flight, more support, and more diversity were recommended. Some areas, such as Earth and Planetary Science had no or very limited opportunities for proposing. One area that was not included in the roadmap is the inclusion of Biological and Physical Sciences (BPS), as it was not part of SMD until after the roadmap was initiated. However, there is clear benefit to flying BPS payloads on high altitude balloons due to the environment effects.

The committee concurred that the Balloon Roadmap is mature. The APAC advised NASA APD to accept the document and review the recommendations and findings within the Balloon Roadmap for consideration and potential action.

Findings

The Balloon Roadmap is mature and complete but lacks a BPS element due to the timing of the publishing of the report and the inclusion of BPS in SMD.

Recommendations

The APAC asks that APD consider the recommendations outlined in the Balloon roadmap.

The APAC suggests that BPS be included in future Balloon roadmaps.

ASTROPHYSICS BALLOON PROGRAM UPDATE

An overview of the balloon program was provided by Thomas Hams. The astrophysics balloon program and continues to provide a much-needed capability to the community. COVID-19 has impacted the 2020 balloon campaign in that there were no flights from Wanaka, NZ, no flights from Fort Sumner campaign, no Long-Duration Balloon flights for 20/21, and no 2021 Wanaka balloon flights. As a result, there is a backlog of flights that APD is working to fly in FY21 (and beyond). Another impact is to the GUSTO mission, who has now baselined the use of a zero-pressure balloon over a super-pressure balloon. Baseline can still be met despite this change.

The committee acknowledges that the Astrophysics Balloon Program has been severely affected by the COVID19 pandemic with numerous cancellations and delays, for example GUSTO. The committee notes that NASA ADP is keeping track of the delays and cancellations and working on rescheduling.

The committee was quite interested to hear about ASTHROS, which will host a small general guest observer IR detector system. The APAC was also apprised that technologies have matured to provide sub-arcsecond pointing on payload platforms. This capability combined with the promise of telescope apertures greater than 2 meters likely will enable a wide range of exciting science. The committee notes that such capabilities could be of value to researchers in other divisions such as Earth and Planetary Sciences Division. The APAC also discussed the potential scientific and workforce development value-add of piggyback payload opportunities. These opportunities are more accessible to institutions/groups that do not traditionally have access to hardware or facilities to carry out full balloon missions.

The committee discussed with APD that real time telemetry access (including over the horizon coverage) and bandwidth poses a challenge to some payloads within the balloon program that may constrict scientific return if left unresolved.

The committee inquired with APD about the storing of balloon mission data and whether it was available to the astronomy community. During the discussion it was explained that balloon missions typically stored there at their home institutions and are not funded to provide processed data to archives

Findings

Delays due to COVID19 in FY20 have resulted in a very full campaign for FY21. APD has a plan to fly these payloads and are accommodating flight opportunities on a best-effort basis reflective of the current-day fluctuations in operational circumstances during the pandemic environment.

More than other NASA Astrophysics programs, the balloon program has been impacted by the COVID19 pandemic.

Recommendations

The APAC suggests that APD consider opportunities for guest observer as they become available through the development of balloon-based observatories and facilities.

The APAC recommends that APD consider increasing accessibility and awareness of piggyback payload opportunities even more. These opportunities are more accessible to institutions/groups that do not traditionally have access to hardware or facilities to carry out full balloon missions.

The APAC suggests that APD investigate the viability of storing processed balloon data that has been published in public archives.

SMD INFORMATION POLICY

The APAC was briefed on the forthcoming SMD information policy. The APAC feels this important policy has the potential to impact research programs in a very significant and long-lasting way. Updating NASA computing policy and procedures is urgently needed, as new technologies and opportunities are evolving very quickly. However, drafting new policies can be very complicated, particularly in regulating software. The new policies may also impose additional costs to researchers if they are required to make open-access versions of all software and possibly commit to long-time maintenance. The APAC notices there is at present no robust public software repository tool, like there is for publications.

The APAC concurred with APD management that implementation of the SMD information policy is a major pivot that will impact how investigators plan, execute, and curate their NASA supported research and analysis activities. However, the APAC was provided with no specific information about the new policy nor documentation to review. The committee was also concerned that the one-month comment period starting in 2021 April might be too short to receive enough input from the community. Furthermore, the public comment period will expire prior to the 2021 June APAC meeting inhibiting any committee comment on the substance of the policy.

The APAC also highlighted the need for APD to proactively engage University sponsored projects and institutional research offices early in the formulation and roll-out of the SMD Information policy to solicit feedback and to educate these administrative organizations about new requirements. Other stakeholder communities in the non-profits, NASA centers, and industrial partner base should also be informed of evolving obligations. A "dear colleague" letter may serve this purpose and elicit engagement.

Findings

The APD should expect upward pressure on requested budgets to fully fund PI compliance with SMD information policy expectations.

Recommendations

The APAC advises the APD proactively engage University sponsored projects and institutional research offices to clearly inform them of the SMD Information requirements.

The APAC request a full briefing the new SMD policies, including the text of the proposed document, at the 2021 June meeting.

PI LAUNCHPAD UPDATE

The APAC was delighted to hear the presentation by Erika Hamden concerning the evolution of the PI Launchpad and commends their initiative and service in making this a reality. The committee believes that such an initiative could be transformative over time and conjectures that there are advantages and long-term value of a) keeping cohorts in touch with each other and mentors going forward; b) tracking long-term outcomes with NASA opportunities from each cohort; and c) following up with participants who have chosen not to PI a mission, in particular. The committee applauds the efforts made to make workshop materials available to the widest audience possible and suggests that future expansion and/or evolution in the selection criteria be considered. The APAC also discussed whether "summer school" efforts directed towards students and post-docs (like the Planetary Science mission development Summer Schools) could have programmatic benefit.

Findings

The PI Launchpad has demonstrated quantitative success in educating potential PIs about how to approach NASA mission proposals.

Recommendations

The APAC recommends the APD consider supporting a long-term extension of the PI Launchpad and to continue outreach to scientists from groups that have previously not been represented among NASA mission PIs.

The APAC requests APD track and report back to the committee at the 2021 October meeting on download statistics and other activity related to accessing PI Launchpad materials.

COPAG/PhysPAG/ExoPAG UPDATES

The Chairs of the PAGs provided the APAC with a brief on their activities, highlighting activities of SIGs, activities at professional meetings, and their commitment and intent to broad diversity within the membership of the various SAGs, SIGs, and other working groups. The APAC was apprised that the COPAG SAG11 – "Cosmic Dawn" activities were halted by COVID19 impacts, and this SAG was dissolved. The committee encouraged the PhysPAG to continue discussion on potential cross-PAG initiatives that focus on cross-cutting technologies and data analysis frameworks. The APAC also discussed the impact of the joint NASA/DOE Request for Information (RFI) on high energy physics and space-based astrophysics, which generated broad community interest, on APD planning.

Findings

The APAC notes receipt of the final ExoPag SAG19 report and closes out this activity.

The joint NASA/DOE RFI highlights the benefit of inter-agency collaboration to advance science.

Recommendations

The APAC challenges the PhysPAG to have terms-of-reference for the Cross-PAG-SAG under development to consider barriers to participation of under-represented groups and under-resourced institutions in NASA space science (see Chart17 PhysPAG presentation) solidified by the June 2021 meeting for committee consideration.

The APAG requests an update from the PAGS on the status of, and any potential actions arising from, their discussions of cross-cutting technologies and data analysis framework at the 2021 October meeting.

ROMAN UPDATE

The Nancy Grace Roman telescope assembly passed critical design review (CDR) in December 2020, and Dr. Julie McEnery briefed the APAC on the work status and major milestones of the project. In particular, the sensor chip assemblies are in flight production and the telescope mirrors and coronagraph relay optics have been polished and coated. Many subsystems have or exceeded TRL-6 or greater. The APAC discussed the community Roman involvement through opportunities announced in the recent ROSES (2021) call and encouraged the current Science Interest Group (SIG) to assist the community build-out. The APAC was also informed that COVID19 impacts have required replanning, with the best-estimate on schedule revisions of the order a few months (at present). The APAC was pleased to learn that a new science filter (K-short) has been added, expanding the science capabilities of Roman.

Findings

Characterization and calibration of the Roman wide-field focal plane is a risk item that needs attention from the project.

Recommendations

The APAC requests an update on the Roman schedule and budget resulting from replan activities stemming from COVID19 impacts.

WEBB UPDATE

The APAC discussed with the Webb project concerns regarding the Observatory's name. The committee was apprised of NASA efforts to study and understand archival documentation and the historical interpretation of Webb's impact on policy initiatives that potentially disenfranchised communities from full participation in science. The APAC agreed that a brief from the NASA historian (or appropriate designee) on the status of this forensics study and historical contextualization contrasted to the current stated Agency principles of workforce diversity, inclusion, equity, and respect is warranted.

The APAC discussed some high-level lessons learned regarding how the Webb project has interacted and engaged the potential community of investigators. The committee reflected that use of "Master Class" workshops to prepare the community for proposing to Webb may be a model for future strategic missions to examine to enable a large, diverse investigator pool to better respond and more efficiently leverage NASA science opportunities.

Findings

Webb is advancing towards launch with modest schedule reserve and ground system readiness is maturing.

Efforts continue to improve the speed and ease of use of the Exposure Time Calculator tools is of high value to the community.

Recommendations

APAC requests an update from the Webb project at the 2021June meeting, specifically the NASA historian (or appropriate designee), on the status of the Webb investigation and the historical lens through which to evaluate the context of past activities within the current framework of NASA's five-key Agency goals, including the NASA 5th pillar.

The APAC recommends that Webb continue or expand the Master Class series for proposers.

RESEARCH AND ANALYSIS (R&A) UPDATE

The APAC was impressed by APD's effective handling of virtual reviews for all R&A programs during the pandemic. Moreover, the adoption of Dual Anonymous Review for ADAP and NuStar Cycle 6 is noteworthy.

The APAC was pleased with the turnout and success of the new Pioneers program.

The APAC was pleased to see that the success rates for XRP have increased from 13% in 2019 to 17% in 2020 and looks forward to future tracking in this growing field. The committee notes that laboratory astrophysics and instrumentation related to exoplanets remains in the APRA program and understands that the programmatic balance in the R&A program awaits guidance from the decadal survey.

The committee discussed with the APD the need for continued effective communications with the astrophysics community. There was agreement that regularization of APD R&A townhalls at the winter American Astronomical Society (AAS) meeting, where the exchange with the community is more of a two-way dialogue, has positive returns to the Division and the community of stakeholders. The addition of virtual town halls, for inclusion as smaller meetings, should also be explored for efficacy.

Findings

The transition requiring Hubble Fellowship host institutions to treat fellows as employees with full benefits is welcomed.

The attentiveness by APD towards the financial support of vulnerable, early career astronomers is commendable.

Recommendations

The APAC suggests that APD consider the utility of continuing virtual proposal reviews post-pandemic.

Sincerely,

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