

NASA Astrophysics

ASTROPHYSICS ADVISORY COMMITTEE

July 20-21, 2022
Meeting

MEETING MINUTES

Kelly Holley-Bockelmann

Kelly Holley-Bockelmann, Acting Chair

HASHIMA

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Hashima Hasan, Executive Secretary

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Tom & Jerry, Inc.*

Wednesday, July 20Introduction and Announcements

Dr. Hashima Hasan, Executive Secretary of the Astrophysics Advisory Committee (APAC), called the hybrid meeting to order. As this was a Federal Advisory Committee Act (FACA) meeting, it was open to the public and all statements were to become part of the public record. This meeting was being recorded on WebEx. By attending the meeting, participants consented to their voice and likeness being recorded and shared on the APAC website and in any media in existence now or in the future. Participants released NASA from any claims and demands that may arise from such use, including claims for compensation. While discussions during the meeting were for APAC members only, the public would have opportunities to ask questions via the WebEx chat feature and a web portal linked in the Federal Register Notice (FRN). There were two public comment sessions on the agenda. All APAC members conversations were to be on the record, and formal minutes were being taken.

The NASA Science Mission Directorate (SMD) Associate Administrator (AA) had appointed the Committee members on the basis their subject matter expertise; as such, they must comply with Federal ethics laws applying to Special Government Employees (SGEs). Committee members were required to recuse themselves from discussion of any topics for which they had personal or institutional financial conflicts of interest (COIs). The following members were known to have COIs: Dr. Louis-Gregory Strolger – James Webb Space Telescope (JWST), Nancy Grace Roman Space Telescope (Roman); Dr. Michael Meyer – JWST. Any members finding additional COIs were obliged to tell Dr. Hasan and recuse themselves during the discussion. Members should address any ethics questions to Dr. Hasan as well.

Dr. Hasan welcomed several new members: Drs. Emily Levesque, Rita Sambruna, Ilaria Pascucci, and Grant Tremblay. Also in attendance was Dr. Alina Kiessling, whose APAC membership was being finalized. Dr. Kelly Holley-Bockelmann served as meeting chair, assisted by Dr. Strolger.

Astrophysics Division Update

Dr. Paul Hertz, Director of NASA's Astrophysics Division (APD), welcomed the Committee members. He acknowledged the APD staff and noted some changes. Most prominently, Dr. Hertz was leaving APD; the new director was to be Dr. Mark Clampin, who would take over in mid-August. There had been other changes as well, which Dr. Hertz reviewed.

Inclusion, Diversity, Equity, and Access (IDEA) permeates everything NASA does. Within this is inclusion and diversity of thought. Dr. Hertz reviewed the four foundational focus areas, calling special attention to enhancement of grants and cooperative agreements to advance opportunities, access, and representation for underserved communities. This affects all activities within NASA's Research Opportunities for Space and Earth Science (ROSES) calls. Not all institutions have the infrastructure necessary for writing proposals, so this type of support has become an element of the implementation plan. APD has piloted many activities within the SMD IDEA program, which Dr. Hertz listed. More such activities will be in the budget request for Fiscal Year 2024 (FY24).

Response to APAC Recommendations

APAC made a number of recommendations at its last full meeting, in March. Dr. Hertz reviewed the APD responses. The FY23 President's Budget Request (PBR) seeks less funding for APD than the Division expected in the runout of the FY22 PBR, which necessitates some changes and delays. While the selection for the next Medium-class Explorer (MidEX) will take place as announced, the mission's Phase B will be extended, resulting in a delayed launch. APAC recommended that the close-out of the Stratospheric Observatory for Infrared Astronomy (SOFIA) extend to FY23 in order to carry out Cycle 10 selections, but there were no selections for that mission cycle. A recommendation to review Guest Observer (GO) funding for Roman is being deferred until the mission is further along. SMD continues

evaluating inclusion plans in grant proposals. In May, APD released a community announcement regarding a probe, as advised in the Decadal Survey (DS, or Astro 2020) and reiterated by APAC.

Several of the APAC recommendations had to do with the naming of JWST and research by NASA's historian, Dr. Brian Odom, on the extent of Mr. Webb's participation in the Lavender Scare while he was at the State Department (State). Dr. Odom and his team have completed their research but the report was still in progress at the time of this meeting. The report will go to Sen. Bill Nelson, the NASA Administrator, and additional information will be made public when Dr. Odom gives a follow-up presentation to APAC. The Committee has advised APD to reconsider the way it names missions; these policies are held by NASA and so internal discussions must take place to address this recommendation.

A recommendation about Balloon Program archiving has been elevated to SMD. NASA is assembling a committee on the program, to function as an APAC subcommittee. There were two recommendations on the Sounding Rocket Program. APAC seeks more frequent campaigns from Australia, which APD will implement within budgetary constraints. The recent Australia campaign was fully successful and the Agency hopes to return every 5 or 6 years. However, it was unclear what APAC sought in its request for tracking metrics, and APD asked for further discussion. Regarding archive modernization, this work is in progress and APD will provide updates regularly, while also connecting to the science community on this topic.

APAC requested a discussion on how inclusion plan critiques are being relayed to the proposers and what efforts are being made to educate potential proposers in this area. SMD is providing resources to proposers and wants to continually improve. One action is to ensure the divisions are using common language and practices. Currently, inclusion plans do not affect selections, though they are evaluated, and the PIs receive feedback. Those with unacceptable plans must correct them first in order to receive funds. SMD hopes to have inclusion plans as a selection criterion, but legal issues are involved. A pool of IDEA experts and scientists who work in that area conduct the inclusion plan reviews. Dr. Kartik Sheth leads the IDEA efforts within APD. Dr. Strolger observed that proposers without good plans will face a lot of work to correct them. Dr. Hertz explained that most proposals come from institutions with inclusion expertise, and NASA asks PIs to turn to their internal organizations for help. The ones with problems are often those who have access to these resources but did not reach out while writing their proposals.

APAC also asked for an update on how APD is meeting DS recommendations for undergraduate and graduate traineeship and augmentation of Laboratory Astrophysics (Lab Astro) funding. APD has little authority for traineeships, and in fact the Future Investigators in NASA Earth and Space Science and Technology (FINESST) program is a research program. This is unlike the National Science Foundation (NSF), which has authority for traineeships. However, NASA did increase FINESST funding. NASA and NSF will convene a FACA panel on Lab Astro priorities, funding, and how to do better by the community. In addressing another recommendation, APD would like APAC to discuss the correct balance for the R&A program in order to determine if adjustments are necessary. The DS specified a number of programs that warrant increased investment.

Decadal Survey

The FY24 budget will be the first to incorporate recommendations from the recent DS. NASA is drafting a Draft Announcement of Opportunity (AO) for a PI-led astrophysics probe, to be released in late July or early August. APD has no current budget for Time Domain Astrophysics and Multi Messenger (TDAMM) astronomy but is using FY23 funds to invest in infrastructure. NASA is also discussing this with international partners and having a workshop in August. Dr. Ryan Hickox asked if probe concepts that include TDAMM elements will be prioritized. Dr. Hertz said that while there will not be extra points as such, the basic science merit area in peer reviews does include whether the proposals advance DS priorities.

While APD is not advocating the start of the next Great Observatory, the Division has begun planning. The House markup of the FY23 PBR references the need for Roman to succeed, so NASA is applying JWST lessons learned where possible. Roman is on track to deliver its commitments and Dr. Hertz believes it will be successful, though it is not without challenges. NASA is formulating a Great Observatories Mission and Technology Maturation Program (GOMAP) and has determined the goals for maturing Future Great Observatory 1 (FGO-1), also known as the InfraRed Optical UV (IROUV) observatory. GOMAP has four stages: 1. programmatic preparation; 2. preparation for pre-Phase A; 3. evolved pre-Phase A; and 4. modified Stages 1 and 2 for FGOs 2 and 3. A notional GOMAP timeline showed how activities will fall in relation to each other; many are concurrent. Independent reviews take place in Stage 1, as SMD already does for many large missions in pre-Phase A. The timeline is entirely dependent on the budget.

Dr. Jessica Gaskin expressed concern about X-ray and Far InfraRed (FIR) work and raised the issue of how to retain the health of those disciplines. Without a certain level of funding, they could wither. Dr. Hertz said that the budget is finite and sets priorities according to the technologies the DS ranks higher. However, he too worries about how to preserve these capabilities. Preservation of communities is a risk element within APD and it is not clear how to address it. There may be mitigations, such as in the suborbital program, which does fund X-ray and FIR astronomy. While this is a practical problem that calls for a solution, APD has limited options and cannot achieve all objectives. A mission to study the Cosmic Microwave Background (CMB) needs to be in position for the second probe. APD has paid to upgrade some center facilities, but large missions often incorporate some of those costs. JWST did, and IROUV will surely have unique requirements that will be part of the project.

Dr. Margaret Meixner asked for more detail on the GOMAP stages. Dr. Hertz suggested that APAC invite Ms. Julie Crooke to provide more detail at a future meeting. APD is working with the NASA centers to develop these and he was not at liberty to reveal those conversations yet. However, at the top level, Stage 1 is precursor science and community involvement. Stage 2 is evaluating trades, like cost vs science, to invest in technologies and studies that lead to Stage 3, which will refine the process of selecting an architecture. This is all notional, however. For each stage, NASA will make announcements to encourage community participation. A graphic showed GOMAP team structures for Stages 1 and 2, and delineated the division among NASA Headquarters, competitions, and the centers and academia. About 80 percent of the funds will be competed. The goal is to be open and inclusive wherever possible. Dr. Tremblay returned to the issue of disciplines at risk. A large gap could be lethal. The science community is eager to help grow the APD budget to accelerate this work and does not want to lose those disciplines. Dr. Hertz cited the hard choices that must be made and the DS direction. APAC can advise. Checklists showed the NASA responses to DS recommendations. The Agency is taking more time on the climate change actions.

Budget/Mission Updates

Budget sand charts illustrated the decrease in the run-out. A chart on the FY23 budget features had not changed since the previous meeting. The Senate has not yet released its markup, but the House markup reduces APD's top line by \$31 million. As the House also designates an additional \$20 million for SOFIA closeout, the total reduction in that version of the budget to the rest of the astrophysics program relative to the FY23 budget request is \$51 million.

Overall selection rates are 25 percent for R&A and 27 percent for the GO program. NASA selected the Falcon 9 Heavy as the launch vehicle for Roman. SOFIA is completing legacy surveys, and 80 percent of Cycle 9 will be completed when operations end on September 30. No selections were made for Cycle 10. The closeout plan will include archiving and helping early career (EC) SOFIA people find new jobs. There will also be an effort to dispose of the assets.

The Galactic/Extragalactic ULDB Spectroscopic Terahertz Observatory (GUSTO) mission, a high-altitude balloon effort, was removed from NASA's 2022/23 Antarctic Long Duration Balloon (LDB) manifest due to the payload team missing a deadline required for launch. The team has been given an extension provided it meets critical launch readiness milestones. The project seems to be on track now and will have a review in early August.

Dr. Tremblay asked if the plan to assist SOFIA workers was set. Dr. Hertz replied that he expected to receive it soon. The DS recommended to not extend SOFIA, and he was not sure that another DS had ever advised program termination. Everything in the recent SR was extended.

XRISM is undergoing Integration and Testing (I&T) in Japan. Euclid is still waiting on a launch vehicle. The Spectro-Photometer for the History of the Universe, Epoch of Re-ionization, and Ices Explorer (SPHEREx) mission had a successful CDR. APD has a good baseline of missions. Community funding as a fraction of the budget has gone up. A sand chart illustrated how today's flagship missions have grown in science-per-dollar value. Roman (on the chart as WFIRST, for Wide Field InfraRed Space Telescope) will be one-third the adjusted cost of the Hubble Space Telescope (HST) with the same sensitivity and 100 times the field-of-view, for example. IROUV will likely be 100 times more powerful than HST while costing a comparable amount.

When outlining the goals for the DS, Dr. Hertz told the panel that NASA wanted it to be ambitious and to change paradigms. This calls for ambitious budgets. A diminished budget leads to a diminished program. He believes the program outlined in the DS is indeed ambitious. While the current budget seems low, these things are cyclical, and everyone should continue to work to realize the dreams embedded in the DS. He thanked the DS for providing a way forward.

On behalf of APAC, Dr. Holley-Bockelmann thanked Dr. Hertz for addressing challenges and being straightforward and enthusiastic. He replied that it has been a pleasure to hold "the best job at NASA." Dr. Meixner said she hoped he will be available to help Dr. Clampin. JWST is amazing and its work should extend further. Dr. Hertz said that it is important to deliver Roman to demonstrate that NASA can apply lessons learned. Once Roman launches, it will drown the world in fabulous science. IROUV and others will be just as exciting. The DS has recommended excellent, exciting missions.

ExoPAG Update

Dr. Meyer began the Exoplanet Program Analysis Group (ExoPAG) report by describing the PAG's charge and vision and listing the Executive Committee members. Dr. Pascucci will be the new chair. ExoPAG had its first in-person meeting for a long time at the recent American Astronomical Society (AAS) conference. One of the topics was community engagement and who explores in this field. Dr. Meyer listed some of the presentations. The PAG has adopted a Code of Conduct (CoC) for meetings, which was important as the meeting at AAS showed the need for mechanisms to deal with issues, along with the importance of having enforcement. A list of recent ExoPAG activities included cross-PAG actions, which are increasingly important. ExoPAG has liaisons to all of the other SMD divisions and reported to the Planetary Science Advisory Committee (PAC) in June. The PAG is also supporting GOMAP precursor science workshops.

Dr. Meyer then gave the status of Science Analysis Groups (SAGs) and Science Interest Groups (SIGs). APAC previously accepted the final reports from SAGs 21 and 22, which are now closed. SAG 23, on debris disk properties of exoplanet hosts, has been initiated. SIGs 2 and 3, on exoplanet demographics and exoplanet solar system synergies respectively, are continuing their work. At the June ExoPAG meeting, those present voted in favor of a proposed finding from SAG 23 that expresses concern about the funding and success rate of the Exoplanets Research Program (XRP). The finding was included in Dr. Meyer's slides. He also presented a preliminary proposal that ExoPAG would like APAC to discuss at the October

meeting, to create a cross-PAG SIG on GOMAP activities for IROUV. He was emphatic that this will not duplicate other work and that all PAGs will be represented. The activity will likely last several years.

Also at its June meeting, ExoPAG talked about TDAMM in exoplanet work, and the new Astrophysics Mission School. Finally, based on everyone's pandemic experiences, the Executive Committee wants to consider new meeting formats to maximize shared time and optimize presentations. This could include asynchronous sessions, etc. Regarding the new SIG, there has been a lot of discussion about IROUV and ExoPAG wants to see how the community interfaces with it. SIG goals would be to be responsive, helpful, and useful, while maybe sharpening the questions that should be answered. The community should have a channel for input. Dr. Hertz noted that Ms. Crooke and others think it will be helpful to learn what the community thinks. Dr. Sambruna asked about TDAMM and exoplanets. Dr. Meyer replied that transits are a time domain phenomenon and the exoplanet community needs to recognize that time domain is important to their work. It is important to be in a position to listen in case things relevant to the community come up.

Advancing Inclusion II: Assessing Community Readiness for Inclusion Plans

Dr. Dara Norman of NOIRLab addressed SMD progress on inclusion plans in grant proposals. Dr. Tim Sacco is a sociologist who works with her, and they participate in the U.S. Extremely Large Telescope Program (USELTP) out of NSF. She previously spoke to APAC in 2020 and introduced three key ideas: access is crucial, policies must be reviewed, and research inclusion must be valued as part of scientific merit. USELTP is funding the development of a toolkit to prepare the community for inclusion requirements in research proposals. She was excited to see that NASA's Astrophysics Theory Program (ATP) ROSES call is requiring inclusion plans as part of a pilot program. The ATP pilot calls for up to two pages addressing plans to create and sustain a positive and inclusive working environment, while also stating contributions the proposed investigation will make toward training and developing a diverse and inclusive scientific workforce.

The ATP inclusion plans were reviewed by a peer review panel made up of individuals with specific Diversity, Equity, and Inclusion (DEI) expertise. These reviews were concurrent with the scientific reviews. In the latter, panelists were asked to provide comments about the inclusion plans but not grades. The DEI panel did grade the proposal plans, but those grades were not a factor in proposal selection. A DEI panel then reviewed the pilot overall and gave feedback to APD on how to proceed. Drs. Norman and Sacco looked at the distribution of grades for all 120 proposals as well as the comments from both the scientific and DEI panels for a sample of 32 proposals, and published a report through AAS in March. They also reviewed the extent to which the astrophysics community appears ready to both draft and evaluate inclusion plans. Dr. Sacco is now taking a deeper dive comparing the comments of the full set of 120 proposals.

The evaluation found that inclusion plans presented a number of themes and subthemes, with proposals often having more than one. Among the more popular themes was "credentialing," in which PIs outlined their personal histories with DEI efforts. This was not associated with high or low rankings. Other popular themes were "leveraging institutional resources" and "fostering inclusive team environment." The latter had a number of specific subthemes indicating how the PIs would accomplish this. For example, CoCs were very popular, though the proposals were often fuzzy on implementation and assessment. "Mentoring" was another common strategy, but the practices were nothing out of the ordinary and this element seemed to be the path of least resistance. Proposals were not often leveraging for equity.

The lowest ranked proposals seldom had plans to "evaluate the environment," which may reflect the difficulties of such evaluations. Conversely, the plans that included this were on the higher end of the grade distribution. "Cross-institutional partnerships" (CIPs) have been shown to have impact, but few proposals included this strategy, possibly because it is difficult to do correctly and in a meaningful way.

There is a dearth of experience with CIPs, and few who attempt it actually leverage the partnerships to support inclusion. Dr. Norman gave examples, explaining that leveraging means setting up the partnership to recruit students or create mentorships. The science reviewers showed a reluctance to comment on CIPs, possibly reflecting inexperience with them. Those critiques that were made, however, tracked well with the assessments of the DEI experts. Overall, there was good matching between the science and DEI panels, but the DEI experts often wanted more depth and detail from the proposals. Dr. Norman hopes to have a more complete report at the end of the year.

The DEI experts determined that proposed inclusion plans were mostly marginal or inadequate, relying on the most easily executed strategies and rarely tackling the most difficult issues. Further, the DEI experts found that many of the themes were not connected to high or low rankings. While reviewers on the science panels often agreed with the DEI reviewers in general, their comments differed in emphasis. Nonetheless, it was encouraging that the differences were not greater. The analysis demonstrates the need for PI training on what makes a good inclusion plan. Without such guidance, NASA might fall short of achieving its inclusion goals. Normalizing best practices will require that the community embrace these goals, which is not consistent with separate evaluation of the plans. Rubrics and guidance will help promote more complete understanding, and this is another area in which DEI experts can play a role.

Dr. Sheth thanked Dr. Norman. In rolling toward an ideal state where the science community understands and incorporates this, he expects it to take time and therefore APD will continue having separate panels for the short term. He asked if the reviews should be longer to enable overlap between DEI and science reviewers. He also wanted to know about plans to monitor follow-through. Dr. Norman said that she had not thought hard about panels, but it would be helpful to have the scientists give grades so the comparisons are easier and more aligned. This would also help with monitoring and understanding. It might be challenging to have the two panels spend more time, however. While the goal is to have one review panel, she agreed that it is early. The work on USELTP at NOIRLab has a long timeline but they plan to release the toolkit soon. They now know what people are doing, doing badly, and not doing at all. Regarding assessment, the thought is to demonstrate progress in both science and the inclusion efforts. She hopes to normalized the inclusion plan as part of science merit.

Dr. Shirley Ho asked about extending workshop training beyond reviewers to the broader community and program officers. Dr. Norman agreed that the entire community needs to understand this. Dr. Sambruna saw “outreach” as a fallback term, and it would be helpful to address this. Dr. Norman agreed. Dr. Tremblay said that NASA needs to train the community before the AOs come out. Dr. Strolger said he was shocked that the DEI experts and scientists had similar responses. He asked about the priorities and how to close the gap. Dr. Norman explained that the scientists and DEI experts are not probing in the same way, which can probably be addressed through training. There were scientists on the DEI panels, and as people write and learn, they will become reviewers at some point. To normalize inclusion plans, NASA will have to bring the panels together. This calls for a culture change that is not easy.

COPAG Update

Dr. Janice Lee, chair of the Cosmic Origins PAG (COPAG), discussed the PAG’s recent activities. A significant fraction of the Cosmic Origins community has been busy exploring the first JWST data. Most JWST EROs are in the area of cosmic origins, as are the majority of ERS and Cycle 1 Treasury programs. These data, which are miraculous, become public immediately. The process has been chaotic but also extraordinary, with possible paradigm shifts on the horizon, in particular for our understanding of the physical conditions of high redshift galaxies. There is a key opportunity with the major attention around JWST to communicate and demonstrate that great observatories offer complementary capabilities and must work together as an ensemble to advance discovery (for example the misconception that JWST is a replacement for Hubble should be dispelled).

COPAG serves as a link between the community and NASA, reporting to the APD director. Dr. Lee described how the work of the PAG's SAG 10, on great observatories, influenced the DS and discussed the connection to the new cross-PAG great observatories SAG to be proposed. COPAG's Executive Committee has a number of members rotating off and efforts are underway to ensure the Committee is fully staffed. Dr. Lee herself is scheduled to rotate off in October.

The PAG's SIGs mirrored those of the DS panels. COPAG has had two active Science/Technology Interest Groups (STIGs), for IR and UV, for a number of years. In addition, there are new SIGs dedicated to galaxies and to stars.IRSTIG has generated much interest, and it's next newsletter will include a summary of the March IRSTIG workshop, which the APAC requested, including discussion of SOFIA and is organizing. Dr. Lee also provided an update on UVSTIG activities, including a AAS splinter session on the new great observatories.

COPAG seeks to determine how to best support and inform NASA astrophysics leadership; Dr. Lee presented a schematic of the basic flow, which incorporates inputs from the SIGs and STIGs to identify precursor science. To ensure depth and breadth, COPAG will need to be responsive to new discoveries that will flow into future architectures and trades. APAC was to hear more about cross-PAG SAGs later in this meeting. Among the highest risks in the profession are challenges with recruitment and retention, especially of software engineers. In order to address these challenges, COPAG will explore partnerships with outside groups that may have data NASA and the PAGs cannot collect due to OMB restrictions. Mr. Mozena asked about bringing on software engineers for shorter terms, which occurs in the technology sector. Dr. Lee replied that the key issue is job security. The technology sector has obvious career paths that are lacking in astronomy. It was significant that the DS acknowledged software developer contributions. They merit respect, and astrophysics needs to communicate that there is a career path. Dr. Ho asked if delayed uptake of AI and ML is a concern stemming from retention issues. Dr. Lee replied that COPAG hopes to have a study in that area in order to answer this question.

Precursor Science Workshop

Dr. Terri Brandt explained that precursor science is a new ROSES element for which APD is offering training via community workshops. The first of these has been held and was aimed at enabling the community to write inclusive proposals for the upcoming call. More than 200 people participated. Precursor science is defined as science investigations that inform future mission architectures and trades, ideally reducing design and/or development risk. This is distinct from the FGO science goals, instead leading to maturation. A timeline showed that the FGOs are in "pre-pre-Phase A." Dr. Brandt summarized talks from a panel on inclusion that generated a lot of discussion. This is a work in progress, and NASA has asked the community to self-organized in order to help develop more precursor science needs and identify notional science gaps.

The gap lists will feature prominently at the second workshop, to be held in September as a virtual event. This workshop seeks to further develop precursor science ideas that will inform the upcoming ROSES call. It will also facilitate community collaboration and inclusion of new people. Another goal is to advance development of science gaps related to the FGOs while creating more connections with technology. Dr. Brandt listed proposed topics for the agenda.

Dr. Gaskin asked about the number of proposals to be funded from the ROSES call and the funding amounts. Dr. Hertz said that the FY23 PBR has \$2.5 million for precursor science. Dr. Brandt added that NASA hopes to be open to a variety of ideas, reviewing whatever comes in. While precursor science will address all three flagships in the pipeline, earlier missions will have precedence. Dr. Tremblay cited the level of community confusion about precursor science. Dr. Brandt replied that it focuses specifically on science, while GOMAP will involve cross-pollination with technology and architecture trades. An exposure calculation would be a step further than this. Dr. Kiessling asked about how the workshop

products will be incorporated into the ROSES call for proposals and when the call is likely to be completed. Dr. Brandt replied that the team was still coming up with a specific schedule, in part because they would like to add input from the second workshop.

Transform to Open Science

Ms. Cynthia Hall discussed SMD's Transform to Open Science (TOPS) initiative. Open-source science is critical to missions such as JWST. Core principles include transparency, access, inclusiveness, and reproducibility. Open science involves collaboration through technology in order to share data, information, and knowledge within the scientific community and the wider public, with the goal of accelerating scientific research and understanding. Data indicate that open science generates a greater number of citations as well. Open-source science is NASA's means of putting open science into practice. To that end, the Agency has developed TOPS, which focuses on education and equality. This SMD effort anticipates funding of \$40 million over the course of 5 years to accelerate the adoption and understanding of open science. Goals include training more than 20,000 scientists and doubling participation by members of historically under-represented communities.

To kick this off, NASA is declaring 2023 to be the "Year of Open Science," during which TOPS will introduce community-building opportunities focused on recognition of open science practices; open, public meetings to enable discussion of open science; sharing "hidden knowledge;" and inclusive collaborations. In conjunction with the American Geophysical Union (AGU), TOPS is developing an open science curriculum with five modules that will address: ethics; tools and resources; open software; open data; and open results. Top-level support will be necessary to change the reward system, and this curriculum is likely to be instrumental in making that happen. The expectation is that at least 75 percent of PIs will move to open science. An upcoming community forum was to bring in more input. Ms. Hall described the elements of capacity sharing within the community and noted that there will be a ROSES call on curriculum expansion. Inclusion is a major part of this effort, and NASA hopes that TOPS will enable people from marginalized communities. The curriculum will be in multiple languages. The plan is to provide templates in addition to having regular community forums.

Dr. Strolger said that a lingering question is whether TOPS may be pushing too much. He would like the curriculum to address how to enable the best completion of work. Ms. Hall said there will be guidance related to regulations. The goal is to be as open as possible but as closed as necessary. Some things do take more time, and the curriculum will address ethics. Dr. Sambruna asked how NASA plans to recruit people to open science, and what success metrics will be used. Ms. Hall replied that she is open to ideas on how best to engage. TOPS will be raising awareness at the centers while also going to organizations with NASA-funded researchers and reaching out to historically under-represented communities. They expect to have a lot of participation from AGU and plan on offering in-person and virtual workshops and training. Metrics include the goals of training at least 20,000 scientists, having 75 percent of scientists doing open science, and doubling participation of under-represented groups.

Dr. Ho asked about how National security and American competitiveness might figure in with respect to the open science initiative. Dr. Ho suggests that in technology community there is a good awareness and discussion on what to do in order to share technology/science while being cognizant of the impact of open science/technology on national security or human rights. There are discussions on how one should only share technology within a community where there is an agreed upon shared values. Ms. Hall said that the "open as possible, closed as necessary" approach will support the ethics component and help ensure collective benefit, respect, and responsibility. The team is looking at what others are doing so they can maintain shared values, including competitiveness. Mr. Mozena asked about engagement with the commercial sector. Ms. Hall replied that TOPS is working with the NASA Ames Research Center (ARC), which has expertise in this area.

Dr. Norman asked about partnering with ground-based observatories. Ms. Hall said the team would like to and would take suggestions for contacts. Dr. Hickox observed that people get positions as a result of having been given credit. He asked if there will be a mechanism by which other institutions can know to reward people for doing open science. Ms. Hall explained that other Federal organizations are doing open science, and NASA is talking with universities about open science and incentives. TOPS can provide templates and resources for institutions that want policies. The program is working on proposal development workshops to access to hidden knowledge and is meeting with a variety of organizations on this. The ROSES calls of the future will have this as a priority.

Dr. Holley-Bockelmann said that this is lovely work and the ethos is great. But broadening participation sometimes means offering the resources and infrastructure to enable participation in science. Ms. Hall replied that core services include hardware, and this is all being considered. She was not yet sure how it will happen, but it is an issue TOPS is aware of. They are looking for TOPS champions, and that includes people with international connections. NASA wants to have a lot of voices at the table.

Astrophysics Theory Program Update

Dr. Stefan Immler discussed APD's response to the DS recommendation to augment and restore annual calls for ATP proposals. APD is still thinking about this, given the budget situation. The Division is also talking to NSF about cosponsoring the Theoretical and Computational Astrophysics Networks (TCAN). Interns are looking at data on costs, how long it takes to get selected, the impact of the biannual ATP program, and the impact of Dual Anonymous (Dual Anon) reviews. APD will make a recommendation at the next APAC meeting. Under the biannual program, selection rates exceed 20 percent, which would drop with an annual program. The recommended change and augmentation might call for cuts in other programs as well. To implement all of the DS recommendations, APD would need a 10 percent increase in R&A funding overall.

One of the options Dr. Immler presented, to add a call dedicated to EC theorists in years with no ATP calls, is being considered because the DS said that the problem with biannual solicitations is that they have the greatest negative impact on EC researchers. This would help alleviate that. Meanwhile, TCAN began as joint program with NSF, but it has been run by NASA alone for several years. If NSF were to rejoin the program, the selection rate would go from three Networks every 2 or 3 years to as many as five selections, assuming current funding levels. Dr. Immler explained that interns are using AI to look at ROSES responses over 10 recent years. They are determining the number of cycles between a PI's first proposal and first accepted proposal. APD hopes to extend the data mining to other R&A programs eventually. In answer to a question, Dr. Hertz said that EC will be defined as 10-years after receiving a PhD, with a waiver for family activities. This is the definition for Roman Technology Fellowships.

Dr. Kiessling asked what might induce NSF to resume funding of TCAN. Dr. Immler said that NSF does some work with NASA on TCAN, for which there is positive feedback. TCAN does not provide exoplanet options. XRP will fund all exoplanet work, but it does not offer an opportunity similar to TCAN, which creates a gap. NASA will address in this in ROSES 23, either expanding XRP or allowing exoplanet work in TCAN. Dr. Gaskin asked about the chances of additional funding. Dr. Hertz replied that the topline is fixed, so any funding added here must be taken from elsewhere. The data analysis will show the extent to which special funding for EC scientists might be needed.

JWST Update

Dr. Smith said that everything is going amazingly well with JWST. The diffraction limit is better than expected, near IR backgrounds are better than expected, and mid-IR is performing as expected. Propellant should last for more than 20 years. A graphic showed the error budget for optical instruments. There is a large degree of margin for the entire system. Sensitivity for the Near Infrared Camera (NIRCam) is

substantially better than expected. Pointing control and stability are better than expected, allowing the telescope to track faster phenomena. This bodes well for future observatories.

APAC had recommended documenting the science performance release notes, and Dr. Smith gave links and data in his slides. The 6-month commissioning summary is 60 pages, covering information from spacecraft to science operations status. A micrometeoroid strike made an uncorrectable change to one of the mirror segments, but the effect is small. The operations staff are looking at whether changing the telescope direction is a viable tactic if this were to occur again. The particle was of a size expected about every 5 years. JWST can take these hits more frequently because of the strong margin.

The level of interest has been high, and two papers using data from Early Release Observations (EROs), have already appeared in the open access archive arXiv. The media coverage was outstanding, as was social media. Anyone can download the Early Release Science (ERS) data, which is available only for Cycle 1. Dr. Smith showed how Cycle 1 data are allocated to various programs. The cycle is overbooked and there will be some rescheduling, but all of the Cycle 1 science will be executed. A timeline showed that the Cycle 2 call will be later in the year. He added that the temperatures are good, and cooler than expected.

Dr. Sambruna said that the mission's popularity is amazing and heartwarming. She wondered if NASA might be missing an opportunity to capitalize on this for the program as a whole. When Dr. Hertz said that NASA cannot advocate; Dr. Sambruna replied that the community can. Dr. Smith said that the public was enthusiastic about work that struck astronomers as boring. Being more open about the struggles and daily work could generate interest in smaller missions. Several APAC members agreed.

Dr. Tremblay congratulated the JWST team, noting the broad support. In 2004, Chandra was hit by an object in space and it affected pointing. He is not hearing that the strike on JWST was strongly detected. Dr. Smith said that it did not show up in telemetry enough to be communicated to him. A larger impact might affect reaction wheels. Dr. Kiessling said that she is hearing people say they are surprised that it is doing so well. She asked if the project team might have been too humble during development. Dr. Smith said that some caution is built into the models, but this also speaks to the care of the team. The performance is not an accident, and it is possible that the uncertainty factor in the models is too large.

Dr. Ho asked about the PR. Dr. Smith explained that NASA makes the media aware of opportunities but does not pay for any of this. The White House decided to roll out a preliminary photo after the NASA Office of Communications informed them it was available. The Office thinks broadly. Dr. Holley-Bockelmann asked if the released data are processed. Dr. Smith said that the early release data are, but it is possible to download the pipeline. There was more care taken with the EROs. Dr. Meixner congratulated the project engineers. She was not completely surprised they surpassed requirements because engineers always work to exceed requirements. Mr. Mozena asked how impact in the public sphere is measured. GO data are released after 6 months. Dr. Smith replied that all early release data are available immediately, and some investigators are releasing their data. The current default exclusive use time is 12 months. This was written into the Memorandum of Understanding (MOU) with ESA. The Space Telescope Science Institute (STScI) has the option to change this but the timeline would need to be discussed. The trend is to release sooner; everyone is tracking this. There will be more image releases, and the plan is to release ERO data until the science community starts producing results.

Dr. Hickox said that it is stunning that this has produced more than people imagined. He asked the extent to which the next cycle will increase sensitivity, and if the exposure time calculator will be modified. Dr. Smith said it may change how people want to observe. As for the calculator, Dr. Jane Rigby said that the plan is to update it by November so that the data will be available for Cycle 2 proposers.

Public Comment Period

The public was given an opportunity to comment. Dr. Holley-Bockelmann had a COI on the Large Interferometer Space Antenna (LISA), so Dr. Tremblay read the first comment on the dashboard, which asked if NASA might increase its LISA contributions in light of the European Space Agency's (ESA's) current issues with mission costs. Dr. Hertz advised holding that question until the second day of the meeting, as a presentation might provide the answer.

Dr. Strolger said that the dashboard question on the NASA historian's work had been addressed in Dr. Hertz's presentation. Regarding another question, about whether TOPS will extend to APD, Dr. Hertz said that TOPS is an SMD initiative that applies to all divisions.

Dr. Jason Tumlinson said that he had been on the Large UV/Optical/IR Surveyor (LUVOIR) science definition team (SDT) and had been at the precursor science workshop. The GOMAP plan presented to APAC was the best version he had seen. In particular, the elevation of the programmatic aspect is really important. LUVOIR learned a lot of lessons about programmatic redesign that were included in its report, and there has been advice come in from industry as well. NASA may also want to look at how Stage 1 and Stage 2 work is distributed and meshed across the three missions. This will occur at different rates for each mission but coordination would be helpful.

Discussion

Dr. Holley-Bockelmann said that in the recommendations from the previous meeting, APAC asked APD to provide metrics on workforce development from the sounding rockets program. Dr. Hertz replied that APD only tracks published papers, and he is not sure what other metrics are out there but would be interested in hearing ideas. Dr. Hickox said that there has been a lot said about people moving up the pipeline to larger scale missions. He wondered if they might be able to look at the career trajectories of sounding rocket PIs. Dr. Hertz replied that Dr. Joan Centrella did that and submitted the paper to the DS. NASA could conceivably continue that work.

Dr. Holley-Bockelmann raised the issues of JWST lessons learned and trying to achieve programmatic balance in addressing Diversity, Equity, Inclusion, and Access (DEIA). Dr. Hertz said the intent is to apply DEIA to the programs. He would welcome feedback as to whether APD is effective and working in the right areas. About one-third of the DS recommendations addressed DEIA. Dr. Sheth is tracking APD's efforts; it takes a while to evaluate this. The funding needs to be embedded in every mission and program rather than in a single program that can be diminished.

Regarding the need to maintain technical expertise, Dr. Gaskin said that one idea is to include the technology priorities in the suborbital program, augmented by other programs. There has to be something. Dr. Kiessling cited the lack of job stability, especially among EC people. Salaries need to be competitive as well. She wondered about having longer-term grants. Mr. Mozena advised changing the approach to retention. Silicon Valley does not see a 3-year gig as problematic, for example. NASA might consider incentivizing shorter-term work. Dr. Gaskin countered that while that works when discussing a viable commercial product, FIR and x-ray are very specialized, with skill sets that need to be handed down. She characterized the skills as both endangered and emerging, and wondered how to keep the pipeline. Dr. Hickox said that in looking at the GOMAP timeline, NASA already knows which skills matter in mission development. That is what everyone learned in the large concept studies. He was concerned with the notional timeline because it depends on keeping shorter-term programs going. NASA may already have what it needs. Dr. Hertz said there is flexibility in allocating funds and APD can do that when GOMAP requires it.

Dr. Kiessling said that because the data scientists must know the deep modeling of astrophysics, it is not as simple as pulling in people from industry. Dr. Holley-Bockelmann wondered if there might be data

science incubators or a boot camp. Dr. Tremblay said that even with a flat topline, phasing for GOMAP can keep those boats afloat. He is encouraged with the GOMAP planning and the multisector approach being taken. Industry is eager to get involved. Also, it is not enough for the community to just come in through the PAGs. The original flagships had a huge grassroots movement pushing them forward.

Dr. Gaskin said that she has never proposed to ATP and wondered how much overlap there is between it and the precursor science ROSES call. Dr. Hertz said that prior precursor science proposals might have been submitted to ATP or the Astrophysics Research and Analysis Program (APRA). Dr. Gaskin asked about the impact a precursor science call might have on selection rates. Dr. Hertz explained that there is new funding for precursor science, and APD had the impression that there might not be a lot of precursor science ideas out there at this time. If the second workshop confirms that impression, the Division can shift some of the funds back into general R&A. Dr. Brandt added that the first workshop was a hodgepodge of ideas, probably because not everyone is familiar with precursor science. One thing APD will do is connect ideas with the R&A programs and try to help the community understand the flow. She expects it to become increasingly relevant over time, and growth is unlikely to be linear. An example is on the agenda for the next workshop. Dr. Smith noted that this will not be a long-lived program, as it will be timed to affect the GOMAP missions.

Dr. Meixner asked how APD weighs increased ATP funding versus putting more into ADAP. Dr. Hertz said there is no algorithm. ADAP is less expensive than some other programs. Dr. Strolger advised doing more than one of the options that Dr. Immler presented, and Dr. Holley-Bockelmann suggested partnering with NSF on an EC call. Dr. Sambruna asked about observing time when there is a need for new solutions. Dr. Hertz explained that precursor science funding will allow a broader range of proposals. Dr. Smith added that observing time on the great observatories might be considered. Dr. Hickox said that a lot of precursor science will be analysis of archival observations. Currently, ADAP does not enable that. Dr. Smith wondered how that might happen. Dr. Brandt explained that this is an important difference. Precursor science looking at Chandra data would be less compelling as straight science but more compelling to help scope a mission, for example. Dr. Tremblay suggested a community-led white paper and asked if the ROSES call for precursor science will allow proposers to say they will use ground-based observatories, which is not always allowed. Dr. Brandt said that that would be considered but there needs to be more discussion about additional facilities.

Dr. Tremblay asked if GOMAPs will have STDTs. Dr. Hertz said that they will be necessary eventually to formulate missions. It might make sense to discuss a pre-STDT, as a lot of things like that led to Roman. Regarding the budget cuts, he will not ask APAC to help balance the budget. The timeline does not work and it is not appropriate. However, APAC could discuss general priorities. The \$10 million request for closeout of SOFIA was probably too small. NASA has told the project to come back with a cost plan for closeout. It could take longer than 1 or even 2 years. All of that will be negotiated. Dr. Sambruna said it was a great precedent to care about the people working on it. Dr. Holley-Bockelmann asked if disposition of assets might involve selling them. Dr. Hertz replied that he understands that this is considered excess government equipment and therefore has to be offered to others within the government first. It belongs to the U.S. government, not NASA. NASA got the Roman mirror from another agency and did not have to pay. The second tier is external, for which there would be proposals. This was done with the space shuttles, which ended up at museums. There are also instruments and 747 parts.

Wrap Up for Day 1

The meeting adjourned for the day at 4:57 p.m.

Thursday, July 21

Opening Remarks

Dr. Hasan opened the second day of the meeting by reviewing the FACA rules and explaining that the meeting was being recorded. There was to be a public comment period later in the morning. WebEx and an electronic dashboard were open for those wishing to comment. All member discussion must be public, and minutes were being taken for the record. APAC members were subject to federal ethics laws and were to recuse themselves for COIs. Dr. Hasan then turned the meeting over to Dr. Holley-Bockelmann, who asked Dr. Tremblay to start the day's presentations.

PhysPAG Update

Dr. Tremblay, chair of the Physics of the Cosmos PAG (PhysPAG) Executive Committee, said that the PAG is energized and ready to work. A lot has gone on since the March APAC meeting. Terms of Reference (TORs) for three new SAGs were ready for review. Two of these were cross-PAG SAGs, indicative of the increasing level of coordination.

The first proposed SAG, involving all three PAGs, would focus on the scientific advances to be made by a fleet of Great Observatories. The DS heavily cited the SAG 10 report on the original great observatories, demonstrating the utility of reports like these. The PAGs want to continue this work. APD and the three PAG executive committees have vetted the TOR. If approved, the SAG could begin work in the fall. The abridged TOR noted key questions, such as the degree to which contemporaneous flight of current, imminent, and future observatories might advance key science questions; what discoveries in the might uniquely be made possible by coordinated use of X-ray through FIR space observatories using powerful and varied instruments; how gaps might be closed by notional missions, to include Explorers and probes; and what might be lost without any of these missions. The PAGs want a broad and inclusive community membership. While other facilities might be referenced, it is important to avoid scope creep and to have a focused report of about 100 pages with figures of merit.

The Gamma Ray Transient Network SAG was proposed for within PhysPAG alone. It will address interplanetary networks (IPNs) and gamma ray transients. The SAG will evaluate possible improvements, community needs, and the potential future missions and instruments needed to realize the DS recommendations regarding partnership with advancing capabilities in other wavelengths and messengers.

Dr. Hickox described the third proposed SAG, which will include all three PAGs and which will be called Astrophysics With Equity: Surmounting Obstacles to Membership (AWESOM). The PAGs brought this concept to APAC's previously meeting. The aim is to increase participation from institutions and groups that currently face barriers. The SAG will analyze how to do this. It has become clear that new activities are trying to increase under-represented communities' input to NASA astrophysics, but there are challenges in terms of infrastructure, resources, etc. The goal of the SAG is to focus on that kind of program, building on existing work to develop basic best practices on how to expand accessibility.

Dr. Sambruna asked how the SAG might complement or differ from NASA's upcoming Bridge program, which has the same intent. Dr. Hickox replied that the Bridge aims at a specific set of people at a specific point in their career. The SAG is looking at the fact that there are scientists at Minority Serving Institutions (MSIs), community colleges, etc., who may be interested in this work but who are not at a place where they can engage with the Bridge program. The aim is to think about expansion beyond the Bridge. Dr. Sambruna said this was exciting. She could see the SAG working with the Bridge and encouraged them to do so.

Dr. Strolger observed that some of these efforts seem to be one sided, and there do not seem to be a lot of budding partnerships with MSIs despite outreach. Dr. Hickox agreed that there has not been the desired uptake. For people to sit on a SAG, they must have time and resources, and not everyone does. Dr.

Strolger advised against overtaxing the MSIs that are engaged, instead reaching out to those who are not yet engaged. Dr. Gaskin wondered if an ambassador program might work. She asked what the SAG's end goal will be. Dr. Hickox replied that the end goal is to identify and develop best practices and different types of resources. Some things are hard to extend, and the SAG would help determine that. Dr. Strolger pointed out that there are many missed opportunities to connect with MSIs. Some are geographically close to the major institutions but the connections are not made. People are not making the effort to walk down the street.

Dr. Tremblay next explained that PhysPAG would like NASA to change the acronym for the Physics of the Cosmos program to something other than PCOS. As it is, the acronym can be jarring since it commonly refers to a gynecological condition. Community feedback indicates that NASA's use of the acronym is both unwelcome and confusing. While it would be daunting to make such a change retroactively, PhysPAG urged NASA to change the acronym going forward, and suggested "PhysCos" as a possibility.

Roman Update

Dr. Julie McEnery opened her presentation on the status of Roman by reviewing the mission objectives. Roman specializes in discovery and covering large segments of the sky. The telescope aperture is the same as that of HST. Current plans are to launch before May 2027, most likely in October 2026. In addition to providing a large field of view, Roman will offer precision, with efficient observations, stability, and excellent flux calibration.

NASA recently selected the launch vehicle, the Falcon Heavy from SpaceX, which means that that cost is no longer a question. Dr. McEnery gave the status of work on the telescope, spacecraft, and ground system. Much of this is being run out of GSFC. More specifically, on the Wide-Field Instrument, the team is assembling and characterizing components and their performance. Meanwhile, work on the coronagraph is going well. The Roman team is still thinking about what the community will want in terms of data and simulations, while proactively making data resources available.

Dr. McEnery then shared some important definitions in the area of cost and schedule. First is the Management Agreement (MA), which is the agreement between NASA and the project, and which includes schedule and funding reserves under the control of the project. The second term is Agency Baseline Commitment (ABC), which is the agreement between NASA and stakeholders such as Congress. This includes additional schedule and funding reserves, held by NASA Headquarters. Changing the ABC is significant.

A May 2021 Covid replan affected both the MA and ABC schedules, and the budgets changed as a result of the schedule increase. This was not a scope or project change. Dr. McEnery showed the current cost and schedule status. At this point, schedule and cost track each other, though there is significant schedule pressure. Covid supply chain issues are effectively general attrition that is hard to pinpoint. Regardless, subcontractors have had significant delays in delivery of components. On the other hand, Roman has a lot of flexibility in the flow of the schedule and expects to have sufficient schedule relief to meet the October 2026 launch date. Dr. Gaskin asked if there will be enough margin following I&T; Dr. McEnery said the margin is assigned across the schedule. The Critical Design Review (CDR) of September 2021 found that the mission is achievable within ABC cost and schedule with high confidence. However, the CDR led to a shift in the MA launch date, while the ABC launch readiness date remains at no later than May 2027.

Goals have been set for community engagement. The Roman team wants community definition and ownership of the Core Community Surveys (CCSes). This means the process will be broad and inclusive so that everyone will have access; it will not be directed by a single team. There will be various avenues for participation independent of proposal selection – these include working groups and community-led

science consortia. Science community funding will also span a range of award sizes and durations. The three CCSes will be the High Latitude Wide Area Survey; the High Latitude Time Domain Survey; and the Galactic Bulge Time Domain Survey. General Astrophysics (GA) surveys will account for at least 25 percent of observing time and come through proposals or other community-recommended processes. Ninety days of coronagraph technology demonstration observations will occur during the mission's first 18 months. To define the CCSes, the project team will hold community workshops detailing Roman capabilities; call for white papers detailing science that can be done with the surveys; and hold additional workshops to enable community cooperation and consensus. These activities were shown on a timeline.

The 2020 DS recommended a non-advocate review of the balance of observing time between core community surveys and general astrophysics surveys. NASA requested that this be done by the Committee for Astronomy and Astrophysics (CAA) at the National Academy of Sciences and Medicine (NASEM). CAA was asked to determine whether the CCS/GA ratio is correct, and to assess the division of observing time within GA. NASA presented material describing the design reference mission. The project gave presentations outlining plans for the community process to define the CCSes, considerations for GA surveys, etc. CAA also heard from a range of other groups and science community members. The CAA report was due soon.

Roman data management and analysis is another topic generating great interest. Downloading and processing the data will likely be impractical for many members of the community. At the same time, few observations will be owned or have identified PIs, so the mission needs archive and processing systems to make this all available, while ensuring that work is not needlessly duplicated. The mission will do much of the processing, and will manage data storage and analysis in the cloud. All Roman data are immediately available with no proprietary period. A graphic depicted the ground system architecture, which is essential in bringing the data down. The Infrared Processing and Analysis Center (IPAC) and STScI will manage much of the data flow. A graphic showed the estimated archive data volumes for the 5-year prime mission. The STScI archive services will bring data to the users, while the Roman Science Platform will bring users to the data. The team is keeping in mind the need for interoperability with NSF's Rubin observatory. Dr. McEnery described the Roman science platform and archive services, which are likely to evolve. The projected architecture will provide many options.

Time Domain & Multi-Messenger Astronomy

Dr. Valerie Connaughton gave this TDAMM presentation in response to an APAC request. The DS mentions TDAMM throughout, emphasizing its value for NASA and setting it ahead of probes in priority. Current observatories are aging, which will necessitate new efforts. The DS recommended having a committee to evaluate the status of ground and international facilities. The report from a 2019 task force on gravitational waves was largely consistent with the findings of Astro 2020.

NASA already covers TDAMM elements in its existing and developmental mission portfolio. Both Swift and Fermi have contributions from European and Japanese partners, and NASA participation in the Israeli Space Agency ULTRASAT continues this international approach to space-based TDAMM missions. As TDAMM pervades NASA astronomy, the response to the DS has been somewhat challenging, but there are four areas of potential: coordination, sustainability, prioritization, and foundations. Coordination will involve recognizing and working within the interagency and international landscape to set priorities and establish a sequence of missions that address science community needs. There is a real danger of losing Multi-Messenger Astronomy (MMA) capacity without this. Coordination also involves consideration of the timing and duration of missions. The astronomy and physics communities run on different timelines, which is another complication. NASA will have to be creative in its prioritization, launching new telescopes in the context of TDAMM as a whole rather than viewing them as independent missions. While the DS recommends a TDAMM program on top of the existing Explorer program, the current

funding situation makes this difficult, though international partnerships might be a plausible route, as are more risk-tolerant, lower-cost opportunities such as Pioneers.

NASA has made the most progress in the area of foundations, or infrastructure. Updating the transient alert system is in the Agency's current PBR, as is study of centralized targets of opportunity. The hope is that this will lead to a centralized guest investigator program that will use NASA missions more efficiently. Interagency coordination will be key, and TDAMM SAGs are in the works. In moving toward an advisory committee, NASA will hold a workshop in August to determine science priorities. The Agency wants APAC input.

Conversation with Mark Clampin

Dr. Clampin spoke with APAC, explaining that he is currently the Science Director at GSFC and will take over from Dr. Hertz in mid-August. He thanked Dr. Hertz for his achievements and help, and also thanked Ms. Sandra Cauffman. This is an exciting time, with JWST's great discoveries, clear priorities from the DS, progress with Roman, and exciting opportunities in TDAMM. His background from working at GSFC is interdisciplinary, which will help bring in synergies with other SMD divisions. He has worked across every part of the astrophysics bandpass and hopes that will be useful.

Dr. Sambruna asked how he sees the implementations of the flagships and if he might intend any differences from Dr. Hertz. Dr. Clampin said he is still getting up to speed. An important lesson is to ensure focus on science goals while avoiding scope creep, which increases cost. It is important to learn from JWST as well. He hopes to focus on DS science priorities and the important technologies, not reinvent the wheel, **as well as learning** from past efforts.

Dr. Strolger noted that while there are no major fires to put out, there are priorities like the SOFIA closeout. He asked about the main challenges for the first year. Dr. Clampin said he wants to keep Roman on track and stay ahead of the fires, which is particularly an issue with hardware. Roman science is important and the highest priority. He is also focused on inclusion but wants to talk internally before making a statement on this. He also aims to stay in touch with the community to ensure NASA is hearing what they have to say and addressing their issues. He wants to get to know the APD team so he can understand what they are doing, and he wants to make sure he understands the status of programs. He does not plan to come in making major changes. Dr. Meixner asked for Dr. Clampin's perspective on using all talent across the country. He replied that he hopes to engage with all the centers and has experience with this as a member of the **Agency's Science Council**, which discusses how science is done at the centers and the challenges. He wants to visit the centers soon after he starts.

Dr. Tremblay stated that the community is facing great headwinds and tailwinds both, and Astro 2020 aligns with the community more than any previous DS. There is a broad, excited, motivated community to help advocate for program and budget growth in order to fly three flagships. He asked what the strategy is for advocacy internally. Dr. Clampin said that a strength is that astrophysics engages the general public and stakeholders on Capitol Hill. Congress is very excited by JWST and the science, and wants to know what NASA will be doing next. NASA needs to tell them what the Agency thinks it is, and APD needs to engage with partners within the Agency to work together, especially with technology. He wants to leverage the excitement from JWST.

Dr. Ho asked how he plans to execute NASA priorities under a tight budget. Dr. Clampin said that the priorities are dictated by the DS at the highest level, but the operating missions and programs of record are also important. He wants to go over all of the budget with Dr. Hertz in order to learn and understand. As for how to interact with APAC, he views the Committee as a point of contact with the community. He will have more on their interactions and how APAC might help at the October meeting.

Dr. Tremblay noted that the SMD AA, Dr. Thomas Zurbuchen, said that future GOMAPs will be built using the JWST model rather than the Roman model – industry participation is greater on the former. Dr. Clampin said that the entire space business has changed, and NASA should not take on what industry can do. Instead, the Agency should lead on technology or fill gaps left by industry. This will help build excitement and interest in the next big flagship mission. Dr. Holley-Bockelmann explained that APAC had been discussing the need to maintain technical expertise across all areas. Dr. Clampin replied that X-ray and FIR do need investments. Large missions run on complex system engineering, so NASA must think about how to sustain that and validate it. He does not want to get to I&T and be stuck at validation. Dr. Holley-Bockelmann added that system engineering is also relevant internationally. Dr. Tremblay said the community wants to work with Dr. Clampin and ensure that the X-ray and FIR communities do not become deserts. Dr. Clampin agreed, saying that there are areas where NASA needs to think longer term. He then thanked APAC and Dr. Hertz.

Public Comment Period

The meeting was opened to the public for comment.

Dr. Strolger read a comment from the dashboard, asking why this group was using the acronym “IDEA” when “DEIA” is more common. It increases confusion. Dr. Hertz said he did not know, but it comes from SMD and there is a rationale. Other institutions use IDEA as well. Dr. Holley-Bockelmann said that “inclusion” is in NASA’s core values. Dr. Hertz said he had just learned that “inclusion” is first in order to emphasize the need for a diverse workforce.

Dr. Strolger read another comment, asking about the process of selecting the new APD director, how this reflects inclusion, and the diversity of candidates. Dr. Hertz replied that NASA conducted a national search in which the Agency posted openly for months and broadly advertised throughout the community. There were many applicants, and Dr. Clampin went through a rigorous process. In creating a diverse workforce, it is important not to judge based on a single selection. The search was very inclusive, going through outlets to recruit members of under-represented groups and making the application process as accessible as possible. He advised looking at the entire SMD leadership to make determinations about diversity. He is the only male division director in SMD, and many other positions are held by people who are not male and not white. Photos are on the NASA website. He recused himself from the selection process.

APAC Discussion

As there were no more comments from the public, Dr. Holley-Bockelmann resumed APAC discussion. Dr. Meixner asked about the strategy for community engagement in Roman. Dr. McEnery said that it is like the Rubin process. The science teams do not have a special place in defining surveys. The science centers will put together a panel to sort through the community white papers. Regarding under-represented groups, Roman held focus groups to learn how to make the process more accessible. This led to a ROSES opportunity for undergraduate research. The team will continue with efforts to learn what makes it easier to propose, such as a suggestion to have an information session with specific examples of what could be proposed. The mission team will do what they can.

Dr. Tremblay asked for the status of Roman’s flat field calibration system. Dr. McEnery said there was a relatively late change in the calibration system, which recently went through CDR. It is scoped to meet requirements. While there was not much more to say at the moment, the results from characterization tests of detectors installed in the mosaic plate have been outstanding. She will have more information at the next meeting. Regarding calibration data, the science center has no more than what the community is seeing; there is no insider access.

Dr. Ho asked about support for data mining (DM) in view of increasing cyber-infrastructure costs, and if this might be an opportunity to partner with NSF. Dr. McEnery said that Roman will do great things, but there are things beyond its scope and beyond the scope of Rubin as well. Both projects feel pressure to meet their requirements. Anything beyond those requirements will need to be done outside of the two missions. Dr. Hertz added that Roman must meet its requirements without any involvement from NSF. Interagency discussions have taken place to examine possible synergies among Roman, Rubin, and Euclid. The Department of Energy (DOE) has also been involved. That team has written a report in which they conclude that the missions require substantial funding. It is possible that other agencies could help with funding. If not, there will not be a coordinated program. Mr. Mozena asked if Roman is the first large mission without a proprietary period. Dr. McEnery said it is not because Fermi also has no proprietary period. Dr. Hertz said that the current SMD policy is that there will not be proprietary time on new missions. Astrophysics is the only community in NASA that has even had proprietary periods. In answer to another question, Dr. McEnery said that she would follow up regarding commercial outreach.

Dr. Meixner asked if the August TDAMM workshop would have representation from all of the wavelength bands in which NASA works. Dr. Connaughton said that that was the plan. Dr. Sambruna observed that the workshop is organized by science theme. The community identified categories of science events, which is how the workshop is organized, but it will cover all wavelengths, gravitational waves, and others. Dr. Connaughton added that one can look broadly at many different science topics within TDAMM. NASA is trying to identify what to address in keeping with the DS emphases. The assumption is that NASA may not be thinking of everything, so the Agency seeks feedback.

Athena Update

Dr. Paul McNamara of ESA explained that the ESA science program includes both optional and mandatory elements. Any country that wants to participate must make a minimum financial contribution based on the national GDP. ESA missions are divided by size, not topic as at NASA, and payloads are paid for by member states. Large flagship missions cost about 1 billion Euros, medium are about half that, “small, fast” missions are around 150 million Euros, and Missions of Opportunity (MoOs) cost less than 50 million Euros.

On Athena, ESA’s largest mission ever, the mission mirror modules use semiconductor technology, with a very low mass. This work is not easy, but the team is making enormous progress. The Scientific Instrument Module (SIM) is quite large. The SIM includes the Wide Field Instrument (WFI) and the X-ray Integral Field Unit (XIFU). The latter is also quite large and requires an efficient cooling system.

Every 3 years, ESA member states review funding for the next 5 years, which allows for long-term planning. The Long-Term Implementation Plan (LTIP) covers current and future projects. LISA and Athena were selected with a Cost-at-Completion (CaC) of 1.05 billion Euros each. While technical progress on both missions has improved significantly over the last 3 years, so has the cost. Athena is now at 1.9 billion Euros and LISA at 1.5 billion Euros, for a total of 3.4 billion committed. These costs are not sustainable in context of a diverse program. There have been some implementation issues with Athena, and a number member states decided they could not contribute as planned, meaning that ESA had to take over. LISA had similar problems.

The ESA Executive has been looking at how to deal with this, and there is no obvious good solution. Should ESA continue with both Athena and LISA in the current configurations, the Agency would have to cut new missions and mission extensions. The result would be a program dominated by Large Missions and lacking diversity, which is key to the Science Program. Therefore, the Executive made a proposal to the Science Programme Committee (SPC) to maintain both program diversity and less ambitious Large Missions. The proposal would rescope Athena and tighten up LISA. Each member state has a vote on this. Athena was originally planned for adoption June of 2023, and the adoption process has been halted,

though that is not the same as a cancellation. ESA will maintain technology development that may be required for a rescoped mission. While rescoping Athena, ESA will also have to consider LISA. The proposal was to maintain costs, look for reductions, and move LISA adoption to November 2023, sooner than originally planned.

Dr. McNamara showed the proposal that the SPC approved. Under this plan, ESA must reduce costs for both Athena and LISA. This requires modification of the Athena science objectives, possibly with some testing changes; the revised mission is tentatively called NewAthena. The target cost is below 1.3 billion Euros, and LISA will have the same financial cap. Whichever of the two missions is technologically ready to enter implementation will be adopted in 2023, adoption being a technology milestone. Independent science review teams will look the science and feasibility of both missions. It is difficult to find reviewers who are both qualified and not already involved in the work, however. Whichever mission is not adopted in 2023 will be adopted when technically ready.

NewAthena will build on the work that has been done, as the investment has been significant. There will be a review later this year but there cannot be any more cost increases. Dr. McNamara listed the steps forward, some of which will take place in parallel. This includes analysis of potential reduced instrument configurations, reformulation of the SDT, and consultation with funding partners. Scientists who were members of core instrument teams will be ineligible for the new SDT, but ESA hopes to have the team in place by October. International partners have been notified and will be engaged in the redefinition process. ESA will also confirm commitments from members. The Agency does not want to reinvent this mission or turn to industry. After reviewing the science case and feasibility and determining if NewAthena is still a flagship mission, the reviewers will present to the SPC. If that body approves, the mission team will find a path forward.

The key point is that Athena has not been canceled, but ESA needs to figure out how to do it within the cost constraints. ESA remains committed to flying a large X-ray observatory.

Dr. Tremblay thanked Dr. McNamara and acknowledged the team's dedication. He noted that the initial white paper to the SPC indicated that LISA was a higher priority. He asked if SPC adopted this language. Dr. McNamara replied that this was not a position, but rather a proposed position. The white paper addressed the need to have a mission in 2023. The SPC will decide which mission, if any, will be adopted then. The mission must cost no more than 1.3 billion Euros. Dr. Holley-Bockelmann asked if the Athena team can be given full visibility into the 1.9 billion Euro figure so that there is agreement before cuts and rescoping take place. Dr. McNamara replied that many costs are industrial and therefore proprietary. If the study team wants more information, they will have to ask for it.

Dr. Strolger said that it sounded as if the 2023 mission has been selected, if not formally. Dr. McNamara explained that if the team can reduce costs sufficiently, Athena could go forward as it is more advanced than LISA. That is unlikely, however, due to the system-level changes required. Dr. Strolger observed that this sounds ambitious. Dr. McNamara said that if it cannot go up in 2023, it will go up when ready. In answer to another question, he said that the decision has already been made to have Athena fly a calorimeter. However, a decision on which one must be made by the end of 2022 if it is to launch next year. Dr. Meyer said he was pleased to hear that ESA will not cancel Athena. He asked if there is a precedent for these walking back of commitments by member nations and if this constitutes a risk to manage. Dr. McNamara explained that while this change in member nation commitments has happened before, it was too much in the case of Athena and it will require examination. This cannot be allowed to happen again. Part of the problem had to do with the timing for implementation of the agreements. The next SPC meeting is in November, and the path forward is unclear if the funds are not made available. If there is a decrease, the mission team will have to take another look at the long-term plan.

Dr. Sambruna relayed a question from the public about whether new ideas might reduce costs. Dr. McNamara said that under no circumstances can ESA allow cost growth. So Athena must rescope or descope the science objectives. It is an unfortunate truth. Dr. Sambruna said that her own question was about LISA, and how to decrease the cost of a mission that is fairly fixed. Dr. McNamara explained that he had been the study scientist for LISA. The spacecraft will be a factor, and it might be possible to minimize testing. The team is confident that they can minimize costs.

Dr. Holley-Bockelmann asked if ESA is looking for changes in what U.S. and other international partners will provide. Dr. McNamara said that if there is U.S. technology that might help, ESA will be interested. No doors are closed for providing the best mission within the constraints. He explained that XIFU and WFI are both essential. ESA costs increased in part due to cooling of the XIFU but the SPC said it has to remain. Dr. Tremblay said that the last he heard was that the contractor achieve a better point spread function than the 8 or 9 arcseconds currently suggested (while still falling short of the original 5 arcsecond requirement). Dr. McNamara said that there is confidence that this can be improved. Even the higher level provides a good science case.

Dr. Meixner said that the recent DS features Athena very heavily even though it is an ESA mission. She asked if the DS influences ESA in any way. Dr. McNamara replied that it does to some extent. ESA is delighted that NASA is involved. Regarding the NASA probe process, ESA may coordinate in order to maximize science return in this field, but the goal is still to have a NewAthena. The previous week, the ESA Executive discussed with the NASA APD director possible studies for increased contributions. ESA hopes to involve NASA as much as possible.

Discussion

Dr. Pascucci expressed concern about the proprietary periods for proposals on JWST. It takes significant effort to write a proposal, and she would not want to see rushed publication or results that undermine the work of younger scientists. Dr. Hertz said these were good points that have been part of the discussion. The current direction he had given within APD except for JWST is that they have no proprietary period, and that one can be extended via waiver when there is a good reason; academic timelines are considered good reasons. For HST, data show that the average time to publication did not change as the proprietary time changed. He only knows of one anecdotal “scoop.” The PI has a huge head start, and bad results will be corrected and damage the PI’s reputation. The zero limited data access period policy is SMD-wide.

Dr. Strolger wanted to know, in context of TOPS, the appropriate exclusive access for PIs to analyze and protect their graduate students. He worries this may push unnecessary change in how the field communicates and publishes. Dr. Hertz pointed out that the rest of SMD “has been at zero forever” in terms of having proprietary access periods. He asked people to wait and see if any of these negative outcomes even happen, and to talk to people in other divisions, since they do not have limited data periods. Dr. Strolger said that he would like to see evidence. Dr. Holley-Bockelmann asked if the other divisions have data to share from transitioning. Dr. Hertz explained that the other divisions never did this, so they did not have any transition. There are astrophysics missions that changed their proprietary periods, and some, including the Imaging X-ray Polarimetry Explorer (IXPE), the Neutron Star Interior Composition Explorer (NICER), and the Transiting Exoplanet Survey Satellite (TESS), had none.

Dr. Meixner said that the AWESOM SAG might talk to the SOFIA mission about their experience sending a diverse team to New Zealand recently. The mission team contacted MSIs to identify and select students, which was effective. There may be other examples of empowering MSIs. In addition to the three SIG TORs, Dr. Sambruna noted the need to sunset the Inflation Probe SAG (IPSIG). She had several concerns. For one, the Great Observatory SAG is good idea, but the scope could be gigantic and unfocused, turning it into a mini-DS. Dr. Pascucci agreed. Dr. Tremblay said that the expectation is that the SAG will focus on the case for panchromatic coverage by a fleet, without wading into individual

science cases for each observatory. Dr. Kiessling thought that having the three observatories up at once seemed like a huge ask, and was pondering a system in which smaller mission classes could enhance the science should the budget not allow contemporaneous flight of all the flagships. Dr. Strolger raised the issue of naming chairs for the proposed SAGs. Dr. Sambruna advised ensuring that members of under-represented communities control and chair AWESOM, instead of having white people feel good about making an effort. Dr. Hickox said that diverse leadership is the intent. The challenge is to make sure the commitment is not overly burdensome. Dr. Holley-Bockelmann wondered if the SAG might have a point of contact instead of a chair.

With no additional concerns raised, APAC came to consensus and approved all three of the proposed new SAGs. APAC also approved the PhysPAG recommendation that APD change the PCOS acronym.

Dr. Sambruna again sought more discussion before closing out the IPSIG, asking what the community thought. Dr. Tremblay explained that he had reached out and gotten little response. The SIG has done great work, but they have not met in several years. It was mission-concept-specific and now is less urgent with the DS issuance. It has not been a coherent group. Dr. Sambruna said that if the community is not kept at the forefront and advocating, the time may come when work needs to be done in this area but the talent does not exist. She suggested rebranding it as CMB instead. Dr. Kiessling agreed with the need to keep the CMB community engaged and recommended trying to reinvigorate the SIG. APAC can revisit the issue if there is a lack of interest. When Dr. Tremblay said he would take it back PhysPAG, Dr. Kiessling said it would be best to have the leaders to indicate that they will maintain it.

Dr. Sambruna asked if there can be a future presentation on TDAMM with time for a full discussion. That was agreed to.

Debrief Division Director

Dr. Gaskin said it is important to maintain the X-ray and FIR communities and APAC should further develop the idea to preserve them. She wanted to ask APD to take steps to incorporate technology development and demonstration. Dr. Hertz asked that APAC note this in its letter to him. APD has discussed suborbital taking on more technology demonstration and less science. This may be a topic for APAC's next meeting. Regarding criteria for ATP funding, that study is already occurring. APD will bring it to the October APAC meeting and ask for input then. APAC would have a hard time debating specific trades but can weigh in on the relative balance of the program. The letter should ask to have data at the next meeting.

Dr. Holley-Bockelmann noted that it is important to monitor the large mission portfolio at ESA, and it may be useful to have another update on Athena in order to study the trades. Dr. Hickox added that they should think about what the Athena situation means for NASA probes. Dr. Hertz explained that the probe no longer has to be complementary to Athena. Many X-ray probe teams ask how to partner with ESA, but ESA can only partner with NASA. The Planetary Science Division (PSD) is experimenting with ESA offering a menu of options for PIs, and SMD does not want other divisions to speed past that. ESA cannot partner on the probe. In addition, Athena's fate will be decided after the probe proposals are due, though NASA will know more before the downselect. PIs will have to gamble on the future, but that always happens. NASA is not going to delay the probe AO; the draft will be out before the next APAC meeting.

Dr. Hertz thanked Drs. Meixner and Meyer for their APAC service and their work as PAG chairs; this was their last APAC meeting. This was also his last APAC meeting, so he thanked the NASA staff who make these things happen and thanked the APAC members. He loved working with them and urged them to keep asking NASA the hard questions. APAC members thanked Dr. Hertz.

Dr. Kiessling noted that the Step 2 MidEX will be selected before the next meeting. Dr. Hertz suggested hearing from the PIs. Dr. Ho said that while COPAG discussed the DS and the TOPS presentation mentioned goals and training, there was little about software, data, and ethical repercussions. Dr. Gaskin suggested having Dr. Crooke come talk and having further discussion about the ability of the communities to continue. That was to go into the letter to Dr. Hertz.

Dr. Holley-Bockelmann made the case for asynchronous sharing of meeting information. While APAC discussions must occur in open session, she wondered if presentations might be made available in advance. This might include the public. Dr. Tremblay asked for another Athena update. Dr. Hertz advised waiting until ESA makes some of the pending decisions. A LISA update might be interesting, but they will probably not be able to say much.

Adjourn

The meeting was adjourned at 2:25 p.m.

Appendix A Participants

Committee members

Kelly Holley-Bockelmann, Vanderbilt University, *Acting Chair*
 Jessica Gaskin, NASA Marshall Space Flight Center
 Erika Hamden, University of Arizona (remote)
 Ryan Hickox, Dartmouth College
 Shirley Ho, Flatiron Institute
 Emily Levesque, University of Washington (remote)
 Margaret Meixner, USRA (remote)
 Michael R. Meyer, University of Michigan (remote)
 Mark Mozena, Planet Labs, Inc.
 Ilaria Pascucci, University of Arizona (remote)
 Rita Sambruna, NASA Goddard Space Flight Center
 Louis Strolger, Space Telescope Science Institute
 Grant Tremblay, Harvard Smithsonian Center for Astrophysics

NASA/JPL

Paul Hertz, NASA HQ

Director, Astrophysics Division

Lorella Angelini
 David Ardila
 Jennifer Baker
 Simon Bandler
 Catherine Barclay
 Manuel Bautista
 Dominic Benford
 Jeffrey Booth
 Alex S. Borlaff
 Terri Brandt
 Joy Bretthauer
 Jenna Cann
 Kenneth Carpenter
 Sandra Cauffman
 Mark Clampin
 Stephanie Clark
 Rachel Cocks
 Valerie Connaughton
 Elbert Cox
 Pat Crouse
 Julie Crooke
 Nino Cucchiara
 Curt Cutler
 Jason Derleth
 Terence Doiron
 Shawn Domagal-Goldman
 Daniel Evans
 Alise Fisher

Alistair Funge
 Ron Gamble
 Barbara Grofic
 Shahid Habib
 Cynthia Hall
 Thomas Hams
Hashima Hasan, NASA HQ
Executive Secretary, APAC
 Elizabeth Hays
 Rebekah Hounsell
 Michelle Hui
 Brian Humensky
 Stefan Immler
 Hannah Jang-Condell
 Bernard Kelly
 Alina Kiessling
 Patricia Knezek
 Jeffrey Kruk
 William Latter
 Janet Letchworth
 Tiffany Lewis
 Jeffrey Livas
 Stephen Maher
 Sangeeta Malhotra
 Eric Mamajek
 Avi Mandell
 Jennifer Mason
 Julie McEnery

Susan Neff
Rachel O'Connor
Joshua Pepper
Robert Petre
Jane Rigby
Rachel Rivera
Aki Roberge
Mary Romejko
Sara Schwartzman
Phil Scott
Kartik Sheth
Chris Shrader
Nicholas Siegler
Jacob Slutsky
Alan Smale

Eric Smith
Katie Spear
Karl Stapelfeldt
Daniel Stern
Eric Switzer
James Thorpe
Eric Tollestrup
Sanaz Vahidinia
Lisa Wainio
Keith Warfield
Brian Williams
Jennifer Wiseman
Allison Youngblood
John Ziemer
Abderahmen Zoghbi

Non-NASA/Unknown

Vincent Albouys
Tom Barclay
Didier Barret
Meghan Bartels
Rachael Beaton
Francesco Bordi
Laura Brenneman
Eric Burns
David Ciardi
Stephen Clark
Angela Clark-Williams
Daniel Clery
Michael Corcoran
Andrew Davis
Monty DiBiasi
Tammy Dickinson
John Dyster
Sylvie Espinasse
Mike Fanelli
Jeff Filippini
Justin Finke
Jeff Foust
Adrian Franzone
Adam Goldstein
Sarah Gossan
Lewis Groswald
George Helou
Lauren Holt
Teresa Jensen
Alina Kiessling
Marina Koren
Janice Lee
James Lochner

Stephan McCandliss
Paul McNamara
David Millman
E. Montiel
Guido Mueller
Dara Norman
Paul O'Brien
Peter Plavchan
Marc Postman
Paul Ray
Enrique Lopez Rodriguez
Richard Rogers
Erin Ryan
Joshua Schlieder
Phil Scott
Peter Shawhan
Elizabeth Sheley
David Shoemaker
Linda Sparke
Robin Stebbins
Tim Sumner
Harvey Tananbaum
Alan Thurgood
Jason Tumlinson
Peter Veres
Alexey Vikhlinin
Ashlee Wilkins
Alexandra Witze

Appendix B
Astrophysics Advisory Committee Members

Charles Woodward, APAC Chair
University of Minnesota

Hashima Hasan, Executive Secretary
Astrophysics Division
Science Mission Directorate
NASA Headquarters

Jessica Gaskin
Marshall Space Flight Center

Erika Hamden
University of Arizona

Ryan Hickox
Dartmouth College

Shirley Ho
Flatiron Institute

Kelly Holley-Bockelmann
Vanderbilt University

Emily Levesque
University of Washington

Margaret Meixner
USRA/SOFIA

Michael R. Meyer
University of Michigan

Mark Mozena
Planet Labs Inc.

Ilaria Pascucci
University of Arizona

Rita Sambruna
Goddard Space Flight Center

Louis Strolger
Space Telescope Science Institute

Grant Tremblay
Harvard-Smithsonian Center for Astrophysics

Appendix C

Presentations

1. Astrophysics Division Update, *Paul Hertz*
2. ExoPAG Update, *Michael Meyer*
3. Advancing Inclusion II: Assessing Community Readiness for Inclusion Plans, *Dara Norman*
4. COPAG Update, *Janice Lee*
5. Precursor Science Workshop, *Terri Brandt*
6. Transform to Open Science, *Yvonne Ivey/Cynthia Hall*
7. Astrophysics Theory Program Update, *Stefan Immler*
8. JWST Update, *Eric Smith*
9. PhysPAG Update, *Grant Tremblay*
10. Roman Update, *Julie McEnery*
11. Time Domain & Multi-Messenger Astronomy, *Valerie Connaughton*
12. Athena Update, *Paul McNamara*

Appendix D Agenda

Astrophysics Advisory Committee Virtual June 20-21, 2022

Wednesday, July 20

10:00 a.m.	Introduction and Announcements	Hashima Hasan/K. Holley-Bockelmann
10:10 a.m.	Astrophysics Division Update	Paul Hertz
11:40 a.m.	ExoPAG Update	Michael Meyer
12:00 p.m.	Lunch	
12:15 p.m.	Advancing Inclusion II: Assessing Community Readiness for Inclusion Plans	Dara Norman
1:00 p.m.	COPAG Update	Janice Lee
1:30 p.m.	Precursor Science Workshop	Terri Brandt
2:00 p.m.	Transform to Open Science	Yvonne Ivey
2:45 p.m.	Break	
3:00 p.m.	Astrophysics Theory Program Update	Stefan Immler
3:15 p.m.	JWST update	Eric Smith
3:45 p.m.	Public Comment Period	
3:50 p.m.	Discussion	APAC members
5:00 p.m.	Wrap up for Day 1	K. Holley-Bockelmann

Thursday, July 21

9:00 a.m.	Opening Remarks	Hashima Hasan/ K. Holley-Bockelmann
9:10 a.m.	PhysPAG Update	Grant Tremblay
9:30 a.m.	Roman Update	Julie McEnery
10:00 a.m.	Time Domain & Multi-Messenger Astronomy	Valerie Connaughton
10:30 a.m.	Conversation with Mark Clampin	Mark Clampin/APAC members
11:00 a.m.	Public Comment Period	
11:10 a.m.	Break	
11:30 a.m.	Athena Update	Paul McNamara
12:30 p.m.	Lunch	
1:30 p.m.	Discussion	APAC members
1:50 p.m.	Debrief Division Director	APAC members
2:00 p.m.	Adjourn	

Appendix E WebEx Chat Transcripts

Wednesday, July 20

Meixner, Margaret (Ext) to everyone: 9:59 AM

Hi Hasima. I am remote

from Meixner, Margaret (Ext) to everyone: 9:59 AM

Can I get the ability to unmute myself?

from Grant Tremblay (Ext) to everyone: 10:00 AM

they're making you a co-host, Margaret

from Meixner, Margaret (Ext) to everyone: 10:06 AM

we cannot see Kelly's face

from Michael Meyer (Ext) to everyone: 10:07 AM

There is no camera at the moment...

from Bernard Kelly (Ext) to everyone: 10:07 AM

Is Paul in Jennifer Baker's room? It's a big group shot, but you can't see anyone up close.

from Michael Meyer (Ext) to everyone: 10:09 AM

Now we can see slides as well as video.

from Kartik Sheth (Int) to everyone: 10:31 AM

We are working on collecting resources for proposers (and program scientists) as we roll out the inclusion plans across SMD.. this is an on-going process. Comments / feedback from community always welcome - feel free to email me or any of the PSs in APD.

from Kartik Sheth (Int) to everyone: 10:33 AM

Yes -- we are going to work on resources and training for the Program Officers as well as they monitor these..

from Kartik Sheth (Int) to everyone: 10:34 AM

@Hashima - can you umute me and add me to the regular panel

from Grant Tremblay (Ext) to everyone: 10:35 AM

We also need to make Margaret, Michael, Erika, Emily, Ilaria co-hosts. I'll ask in the room

from Kartik Sheth (Int) to everyone: 10:35 AM

@Lou - This will be the first year where we will start asking folks to get their inclusion plans up to "par" - and sitll working out how to do this..

from Kartik Sheth (Int) to everyone: 10:36 AM

@Lou - for those who are not selected say - PSs are always happy to do de-briefs but we will have to make sure how to manage this..

from Kartik Sheth (Int) to everyone: 10:36 AM

YES!

from Kartik Sheth (Int) to everyone: 10:36 AM

@Grant - can you just say YES To the,

from Kartik Sheth (Int) to everyone: 10:36 AM

them for me

from Kartik Sheth (Int) to everyone: 10:37 AM

@Grant – thanks

from Grant Tremblay (Ext) to everyone: 10:38 AM

i've given them a list of additional people to make co-hosts (including Erika Emily Michael Margaret, etc.)

from SANDRA CAUFFMAN (Int) to everyone: 10:50 AM

We have to wait until Paul stops talking to allow the host to give you co-host permissions.

from kelly holley-bockelmann (Ext) to everyone: 11:02 AM

Thanks Margaret -- I got you!

from Grant Tremblay (Ext) to everyone: 11:06 AM

Erika has a question too Kelly - Erika welcome to go before me because she hasn't spoken yet

from kelly holley-bockelmann (Ext) to everyone: 11:06 AM

SUre thing -- SOrry, Erika, I didn't see your hand! You're next and then Grant

from Erika Hamden (Ext) to everyone: 11:06 AM

Thanks!

from Erika Hamden (Ext) to everyone: 11:10 AM

I can't unmute myself

from kelly holley-bockelmann (Ext) to everyone: 11:11 AM

I'll unmute folks if I see you're locked

from Erika Hamden (Ext) to everyone: 11:13 AM

Thank you, Paul!

from Grant Tremblay (Ext) to everyone: 11:32 AM

that was Mark Mozena

from Aki Roberge (Int) to everyone: 11:40 AM

LOL Paul

from Erika Hamden (Ext) to everyone: 11:40 AM

Thanks for all the work, Paul!

from Aki Roberge (Int) to everyone: 11:58 AM

I agree with Mike that a new cross-PAG SIG for IROUV would be useful.

from Stephan McCandliss (Ext) to everyone: 11:59 AM

Second that on new cross-pag sig...

from Stephan McCandliss (Ext) to everyone: 12:04 PM

Consider making at a cross-pag Science & Tech Interest Group (STIG) for IROUV...

from Kartik Sheth (Int) to everyone: 12:53 PM

Kelley you will have to unmute me again - force of habit - I muted myself

from Kartik Sheth (Int) to everyone: 12:53 PM

thnx

from Kartik Sheth (Int) to everyone: 12:58 PM

@Shirley - we are certainly thinking of doing trainings for both program managers and the community :)

from Grant Tremblay (Ext) to everyone: 1:00 PM

thumbsup to that Kartik

from Kartik Sheth (Int) to everyone: 1:01 PM

@APAC - we would be very keen to get creative ideas from you as we work towards the new "normal" that we want to work towards :)

from Tiffany Lewis (Ext) to everyone: 1:04 PM

A lot of problems can be solved by sharing a full desktop rather than the application

from Kelly Holley-Bockelmann (Ext) to everyone: 1:28 PM

I'm seeing Alina, then Margaret, then Shirley

from Kelly Holley-Bockelmann (Ext) to everyone: 1:28 PM

Oh, Alina, did you give up?

from Alina Kiessling (Ext) to everyone: 1:28 PM

My question was somewhat to Paul, so while he isn't here, I will wait

from Rachael Beaton (Ext) to everyone: 1:29 PM

I'm taking detailed notes!

from Enrique Lopez Rodriguez (Ext) to everyone: 1:29 PM

there are some science postdoctoral positions between Amazon and universities that try to address this issue. These positions are new (i.e. in the past year or so), so I'm not sure if there are some statistics from the people that have taken these positions.

from Enrique Lopez Rodriguez (Ext) to everyone: 1:30 PM

i.e.: <https://www.amazon.science/postdoctoral-science-program>

from Kelly Holley-Bockelmann (Ext) to everyone: 1:31 PM

Thanks, Enrique -- good example of Mark's proposed model!

from Kartik Sheth (Int) to everyone: 1:32 PM

+1 Enrique - had some discussions with Spergel about this at Flatiron on my last visit as well - will be key for us to effectively change the culture to allow for flow back and forth..

from Enrique Lopez Rodriguez (Ext) to everyone: 1:34 PM

Yes, one may envision a 50/50 FTE (or some other fraction depending on the goals of the fellow) between industry and academia, which may solve some of these issues of retention and salary gaps.

from Grant Tremblay (Ext) to everyone: 1:34 PM

I assure you that the room Terri is sitting in is not that lush and green

from Enrique Lopez Rodriguez (Ext) to everyone: 1:35 PM

+ bringing expertise/tools and people power from industry to academia

from Terri Brandt (Int) to everyone: 1:57 PM

@Grant -- lol. But what if it were? :)

from Grant Tremblay (Ext) to everyone: 2:14 PM

Here's the TOPS Github that Cynthia mentioned: <https://github.com/nasa/Transform-to-Open-Science>

from kelly holley-bockelmann (Ext) to everyone: 2:23 PM

Ryan, I see you -- you're after Dara

from kelly holley-bockelmann (Ext) to everyone: 2:25 PM

TOPS and NOIRLab should meet -- Cynthia, meet Dara. :)

from Cynthia Hall (Int) to everyone: 2:34 PM

TOPS website: <https://science.nasa.gov/open-science/transform-to-open-science>

Email list for announcements: <https://bit.ly/3JXQQ1Q>

from Stephan McCandliss (Ext) to everyone: 2:35 PM

your mics are hot...

from Kartik Sheth (Int) to everyone: 3:03 PM

We can't hear Stefan

from Elizabeth Sheley Ext (Ext) to everyone: 3:03 PM

Can't hear

from Emily Levesque (Ext) to everyone: 3:03 PM

Ditto

from Grant Tremblay (Ext) to everyone: 3:03 PM

oh sorry! hold on

from Kartik Sheth (Int) to everyone: 3:03 PM

Thanks Stephan - now you got them totally muted! ;)

from Grant Tremblay (Ext) to everyone: 3:03 PM

can you hear now?

from Kartik Sheth (Int) to everyone: 3:04 PM

Nope

from Ilaria Pascucci (Ext) to everyone: 3:04 PM

no

from Elizabeth Sheley Ext (Ext) to everyone: 3:04 PM

no

from Kartik Sheth (Int) to everyone: 3:04 PM

Start over

from Grant Tremblay (Ext) to everyone: 3:04 PM

try now?

from Kartik Sheth (Int) to everyone: 3:04 PM

Good!

from Stephanie CLARK (Int) to everyone: 3:04 PM

Yes

from Emily Levesque (Ext) to everyone: 3:04 PM

yep!

from Grant Tremblay (Ext) to everyone: 3:04 PM

good

from Elizabeth Sheley Ext (Ext) to everyone: 3:04 PM

yes

from Ron Gamble (Ext) to everyone: 3:08 PM

Proposals for early-career theorists would be fantastic! 🙌

from Dominic Benford (Ext) to everyone: 3:17 PM

Minor correction to Paul's statement on RTF: candidates must have received a Ph.D. degree on or after January 1 of a year that is no more than eight years prior.

from kelly holley-bockelmann (Ext) to everyone: 3:18 PM

Thanks for the correction, Dominic!

from Grant Tremblay (Ext) to everyone: 3:18 PM

ah okay, thanks Dominich <https://science.nasa.gov/researchers/sara/fellowship-programs/nancy-grace-roman-technology-fellowships-astrophysics-early-career-researchers#:~:text=The%20goals%20of%20the%20Nancy,development%20projects%20and%20become%20principal>

from Grant Tremblay (Ext) to everyone: 3:18 PM

(oops, messed up the link to RTF for context): <https://science.nasa.gov/researchers/sara/fellowship-programs/nancy-grace-roman-technology-fellowships-astrophysics-early-career-researchers#:~:text=The%20goals%20of%20the%20Nancy,development%20projects%20and%20become%20principal>

from Ilaria Pascucci (Ext) to everyone: 3:18 PM

Yes, tahk you

from Tiffany Lewis (Ext) to everyone: 3:21 PM

I think the recommendation is intended as the allocation of additional funding to ATP because we need more work done in Theory. Most of these proposed solutions strike me as - how can we avoid this recommendation because we don't want to reallocate

from Dara Norman (Ext) to everyone: 3:22 PM

Dual anonymous does not create equity so there is no guarantee that it would boost early career enrollment.

from Dara Norman (Ext) to everyone: 3:22 PM

or success

from Eric Smith (Ext) to everyone: 3:22 PM

I can't unmute

from kelly holley-bockelmann (Ext) to everyone: 3:24 PM

My read of the Decadal was the same as yours -- that the spirit of the decadal was to increase the total amount of ATP funding.

from kelly holley-bockelmann (Ext) to everyone: 3:25 PM

Thanks for jumping in, Grant!

from Alina Kiessling (Ext) to everyone: 3:25 PM

I wonder if a collaboration with the NSF on TCAN could increase funding availability overall?

from kelly holley-bockelmann (Ext) to everyone: 3:27 PM

I was wondering if NSF and NASA might take turns doing an early-career ATP one year, then AAG theory the next?

from Shirley Ho (Ext) to everyone: 3:29 PM

thumbs up to both 1/ early career ATP and AAG 2/ More funding for ATP in general (implementing the decadal survey recommendation)

from Jane Rigby (NASA; she,her) (Int) to everyone: 3:33 PM

TMZ and People, y'all.

from kelly holley-bockelmann (Ext) to everyone: 3:33 PM

Y'all are famous!

from Jane Rigby (NASA; she,her) (Int) to everyone: 3:34 PM

People magazine quoted John Mather, and published the ERO images. Just take a moment to absorb that.

from kelly holley-bockelmann (Ext) to everyone: 3:36 PM

JWST for TIME's Person of the Year? People's Most Beautiful Stargazer?

from Sangeeta Malhotra (Int) to everyone: 3:39 PM

JWST comissioning bingo.

from kelly holley-bockelmann (Ext) to everyone: 3:42 PM

Jane, I got you after Shirley, but holler if you need to jump in earlier

from Jane Rigby (NASA; she,her) (Int) to everyone: 3:49 PM

More than 100 TB of JWST data was downloaded in the first 2 days

from Marc Postman (Ext) to everyone: 3:49 PM

+1 Margaret

from Grant Tremblay (Ext) to everyone: 3:49 PM

+1000 Margaret to the Engineers!

from Jane Rigby (NASA; she,her) (Int) to everyone: 3:50 PM

x10²³ props to the engineers

from Grant Tremblay (Ext) to everyone: 3:50 PM

"Names you'd know only in failure, forgotte in triumph". Let's not let that happen

from Grant Tremblay (Ext) to everyone: 3:56 PM

POTUS called Jane's mom!

from Patricia Knezek (Int) to everyone: 3:58 PM

FABULOUS JOB, JWST Team!

from kelly holley-bockelmann (Ext) to everyone: 4:01 PM

Jason. you

from kelly holley-bockelmann (Ext) to everyone: 4:01 PM

are up next

from Patricia Knezek (Int) to everyone: 4:02 PM

Through the OSTP Subcommittee on Open Science, other federal agencies, such as NSF, are also looking at partnering with NASA on TOPS.

from Lou Strolger (Ext) to everyone: 4:02 PM

Thanks Pat

from Grant Tremblay (Ext) to everyone: 4:03 PM

+1 JT thank you!

from Jason Tumlinson (Ext) to everyone: 4:03 PM

AND of course JWST rules, thanks to Eric and Jane and all for that!

from Jane Rigby (NASA; she,her) (Int) to everyone: 4:09 PM

Where "and all" is the estimated 20,000 people who built or commissioned JWST.

from Lou Strolger (Ext) to everyone: 4:19 PM

Does anyone on the committee on-line have comments to add?

from Lou Strolger (Ext) to everyone: 4:19 PM

If so, raise hand.

from Jason Tumlinson (Ext) to everyone: 4:21 PM

that sounds like something I would say, Grant

from Jessica Gaskin (Int) to everyone: 4:23 PM

+1 Grant

from Jason Tumlinson (Ext) to everyone: 4:24 PM

Grant is stating a lot of what I like about the GOMAP plan - spans all missions, includes centers, academia, and industry, and improves odds of cost savings by reuse.

from kelly holley-bockelmann (Ext) to everyone: 4:28 PM

Eric hang on...I got you in a sec

from Eric Smith (Ext) to everyone: 4:31 PM

still muted

from kelly holley-bockelmann (Ext) to everyone: 4:32 PM

Margaret, you're up next

Thursday, July 21

from Rita Sambruna (Int) to everyone: 8:56 AM

Can you unmute me

from Rita Sambruna (Int) to everyone: 9:00 AM

Hashima we can't hear you

from Brian Williams (Ext) to everyone: 9:00 AM

I can hear Hashima fine

from Brian Williams (Ext) to everyone: 9:00 AM

I can hear Sandra too

from Meixner, Margaret (Ext) to everyone: 9:01 AM

I cannot unmute myself

from Rita Sambruna (Int) to everyone: 9:03 AM

I can hear but can't unmute myself

from Rita Sambruna (Int) to everyone: 9:04 AM

Kelly can I be unmuted please

from Rita Sambruna (Int) to everyone: 9:05 AM

Sandra can you unmute me please

from kelly holley-bockelmann (Ext) to everyone: 9:06 AM

Apologies, friends -- I took my time getting set up this morning. Looking forward to our meeting today!

from Rita Sambruna (Int) to everyone: 9:06 AM

Kelly I need to be unmuted

from kelly holley-bockelmann (Ext) to everyone: 9:07 AM

You mean being made co-host, Rita? Could Rita please be made co-host?

from Rita Sambruna (Int) to everyone: 9:07 AM

thank you, yes.

from Lou Strolger (Ext) to everyone: 9:07 AM

Lou Strolger as well, thx

from Emily Levesque (Ext) to everyone: 9:10 AM

yep!

from Nino Cucchiara he/him, NASA HQ (Ext) to everyone: 9:33 AM

Q: Unfortunately faculty and students do not have the luxury of engaging outside their institutions due to teaching commitments, lack of funds and infrastructure. Also, many MSIs, as you refer to, are mostly undergraduate only institutions, so no grad-students. I would be cautious in generalizing that MSIs are "ready to provide students, faculty and time" in engagements like the one presented

from kelly holley-bockelmann (Ext) to everyone: 9:33 AM

+1 Nino

from Grant Tremblay (Ext) to everyone: 9:34 AM

+1 Nino

from Nino Cucchiara he/him, NASA HQ (Ext) to everyone: 9:37 AM

MUREP is focusing on the educational side of the story. The risk is that MSIs see this as a one-off, for the benefit of "checking the diversity box". Mistrust towards NASA/NSPIRES is widely spread. You need to break this first.

from Nino Cucchiara he/him, NASA HQ (Ext) to everyone: 9:38 AM

A constructive comments: use the boots on the ground: NPP, NHFP and NSF Astronomy fellows. Ask them to engaged with faculty and students in MSIs and R2

from kelly holley-bockelmann (Ext) to everyone: 9:38 AM

And also MUREP (in my experience, so YMMV) tends to be space engineering.

from Nino Cucchiara he/him, NASA HQ (Ext) to everyone: 9:39 AM

@Kelly, not necessary, 25% money has to go to students for research (widely)

from Nino Cucchiara he/him, NASA HQ (Ext) to everyone: 9:39 AM

Go UVI!

from kelly holley-bockelmann (Ext) to everyone: 9:39 AM

No I understand that, sorry, but I mean that the focus of the education and research is not astro (except UV :))

from kelly holley-bockelmann (Ext) to everyone: 9:40 AM

But +++1 to all you're saying, Nino

from Nino Cucchiara he/him, NASA HQ (Ext) to everyone: 9:40 AM
@Kelly, it depends. At UVI we had students working on astro project for full 15 years, with more than 20+ students

from Kelly Holley-Bockelmann (Ext) to everyone: 9:41 AM
Agree! That

from Kelly Holley-Bockelmann (Ext) to everyone: 9:42 AM
is the one astro program I know and it is awesome, congrats!

from Dominic Benford (Ext) to everyone: 9:42 AM
+1 Grant - have always felt PCOS acronym was problematic!

from Kelly Holley-Bockelmann (Ext) to everyone: 9:44 AM
Apologies, for cutting off the conversation -- promise we'll return to it.

from Grant Tremblay (Ext) to everyone: 9:59 AM
Sandra, did I see you raise a hand?

from SANDRA CAUFFMAN (Int) to everyone: 9:59 AM
I wanted to help Julie

from SANDRA CAUFFMAN (Int) to everyone: 9:59 AM
If needed

from Valerie Connaughton (Ext) to everyone: 10:15 AM
No worries!

from Kelly Holley-Bockelmann (Ext) to everyone: 10:16 AM
Valerie, I'm sorry about our schedule creep. Will try to reign us in...

from Kelly Holley-Bockelmann (Ext) to everyone: 10:18 AM
Folks, I'm going to ask Julie if she is available to stick around for questions. The Q+A needs to be public, so we can't do it during break, but perhaps she can be available during the public comment period and discussion...

from Mark Clampin (Ext) to everyone: 10:21 AM
I am here no need to rush

from Kelly Holley-Bockelmann (Ext) to everyone: 10:25 AM
Thanks, Mark. Also, hello!

from Kelly Holley-Bockelmann (Ext) to everyone: 10:26 AM
I love it -- "non-photons"

from Rita Sambruna (Int) to everyone: 10:32 AM
The new GCN just launched today!

from PAUL HERTZ (Int) to everyone: 10:33 AM
+1 Rita

from Eric Burns (Ext) to everyone: 10:33 AM
<https://gcn.nasa.gov/>

from Kelly Holley-Bockelmann (Ext) to everyone: 10:33 AM

Thanks for the heads up, Rita and Eric.

from kelly holley-bockelmann (Ext) to everyone: 10:34 AM

Is the gravitational wave taskforce report available? Sorry, I haven't seen it.

from Rita Sambruna (Int) to everyone: 10:35 AM

yes kelly

from Terri Brandt (Ext) to everyone: 10:35 AM

There's also the MMA SAG report as well

from Rita Sambruna (Int) to everyone: 10:35 AM

it is hiding on the PCOS SAG page

from kelly holley-bockelmann (Ext) to everyone: 10:35 AM

Thanks!

from Valerie Connaughton (Ext) to everyone: 10:38 AM

Kelly - the link to the GW Taskforce is linked on the slide

from Grant Tremblay (Ext) to everyone: 10:43 AM

thank you and welcome, Mark!!

from Rita Sambruna (Int) to everyone: 10:58 AM

I had the same question! how can the APAC best help you?

from Grant Tremblay (Ext) to everyone: 11:01 AM

Thank you, Mark! We have energized and unified industry colleagues ready to work and build (including in parallel!)

from Jessica Gaskin (Int) to everyone: 11:06 AM

Thanks Mark!

from Patricia Knezek (Int) to everyone: 11:07 AM

Inclusion has to come first! IDEA!

from Lauren Holt (Ext) to everyone: 11:08 AM

They mentioned in a recent meeting that inclusion comes first

from Sangeeta Malhotra (Int) to everyone: 11:08 AM

+1 to what Pat Knezek said. And IDEA is easier to say

from Grant Tremblay (Ext) to everyone: 11:13 AM

last chance for comment!

from Grant Tremblay (Ext) to everyone: 11:22 AM

still planning on submitting that "elliptical galaxies have brighter envelopes than expected" paper

from kelly holley-bockelmann (Ext) to everyone: 11:27 AM

Paul McNamara -- welcome. We're finishing with some questions, but I'll try to get to you as close to on time as possible

from Michael Meyer (Ext) to everyone: 11:28 AM

Is the revised agenda posted somewhere?

from Michael Meyer (Ext) to everyone: 11:28 AM

Or we are on schedule, but talking through the break...

from Grant Tremblay (Ext) to everyone: 11:29 AM

yeah, schedule on the website is current. WE're just running through the break

from kelly holley-bockelmann (Ext) to everyone: 11:29 AM

our agenda is in the same order as on the website, just running late

from Grant Tremblay (Ext) to everyone: 11:29 AM

starting with Paul soon (welcome Paul!)

from Valerie Connaughton (Ext) to everyone: 11:34 AM

Bye everyone!

from Valerie Connaughton (Ext) to everyone: 11:34 AM

Thanks for your attention

from Grant Tremblay (Ext) to everyone: 12:05 PM

(just pre-raising my hand, Kelly - happy to wait until Paul is done)

from Rita Sambruna (Int) to everyone: 12:23 PM

Kelly I also got a qs from the public

from Grant Tremblay (Ext) to everyone: 12:35 PM

We had a communtty hand from Simon, Kelly

from Grant Tremblay (Ext) to everyone: 12:35 PM

(do you still have your question Simon?)

from kelly holley-bockelmann (Ext) to everyone: 12:35 PM

I can't call on Simon.

from kelly holley-bockelmann (Ext) to everyone: 12:36 PM

I was told that as an employee of Goddard, Simon can't formally ask a question. Apologies, y'all

from Grant Tremblay (Ext) to everyone: 12:39 PM

Thank you so much, Paul!

[Technical difficulties prevented capture of the complete chat from 12:39 to adjournment at 2:25 p.m. A few comments are below.]

from Alina Kiessling (Ext) to everyone: 1:39 PM

Margaret has cohost status currently.

from Ilaria Pascucci (Ext) to everyone: 1:39 PM

How can we make sure we know about the negative outcomes?

from Rita Sambruna (Ext) to everyone: 1:42 PM

Can we also go back to TDAMM?

from Ilaria Pascucci (Ext) to everyone: 1:47 PM

I am muted.