NASA Astrophysics

ASTROPHYSICS ADVISORY COMMITTEE

June 27-28, 2023
Hybrid Meeting

MEETING MINUTES

August 15, 2023

Dr. Holley-Bockelmann, Chair

HASHIMA HASAN

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Hashima Hasan, Executive Secretary

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Tuesday, June 27

Introduction and Announcements

Dr. Hashima Hasan, Executive Secretary of the Astrophysics Advisory Committee (APAC), welcomed the members of the committee to the meeting and called the meeting to order at 9:01a.m. EDT. APAC is a federal advisory committee established under the Federal Advisory Committee Act. The meeting is open to the public and is being recorded on Webex by NASA. By attending the meeting, participants consent to their voice and likeness being recorded for use for government purposes on the APAC website and in any media now known or hereafter devised. Participants released NASA from any claims and demands that may arise from such use, including claims for compensation. Although this is an open meeting, members of the public have been muted so that speakers or committee members are not interrupted before, during, or after their presentations. Any member of the public may enter comments or questions in the chat feature of the Webex. The Chair will prioritize the comments or questions and address them during the public comment period. Any member of the public who wishes to speak during the public comment period must use the raised hand feature to be recognized by the Chair before unmuting and speaking. All presentations, discussions and comments by the committee members were on the record, the meeting was being recorded, and formal minutes were taken.

The NASA Science Mission Directorate (SMD) Associate Administrator (AA) appointed the members of APAC based on their subject matter expertise as individuals, and each member must comply with the Federal ethics laws applying to Special Government Employees (SGEs). Committee members should recuse themselves from discussion of any topics for which they had personal or institutional financial conflicts of interest (COIs). The following conflicts were identified and the members were requested to leave during the presentation and discussion of the topics noted: Dr. Alina Kiessling from JPL on Roman and NuSTAR and Dr. Regina Caputo from the Goddard Space Flight Center for Roman, Fermi and Swift. Although Dr. Caputo does not have a financial conflict being a civil servant, Goddard manages these missions. Members should address any ethics questions to Dr. Hasan.

During the COPAG, PhysPAG and ExoPAG discussion, the APAC will be discussing the reports that are posted on the public APAC website.

Dr. Hasan introduced Dr. Kelly Holley-Bockelmann, APAC Chair, who welcomed everyone and thanked the members of the committee and the public for attending the meeting. The agenda was designed to allow for robust discussion.

Astrophysics Division Update

Dr. Mark Clampin, NASA's Director of the Astrophysics Division (APD) welcomed all committee members to the meeting. He began his presentation by reviewing the current organizational chart for the Division. There have been several new additions to the program scientists: David Morris, deputy for Explorers, CubeSats and the Astrophysics Research and Analysis (APRA) Program; John Wisniewski, deputy for SPHEREx and XRP; and Sanaz Vahidinia, who be overseeing XRISM and the infrared (IR) portfolio.

The first anniversary of the James Webb Space Telescope (JWST) science operations is coming up in the middle of July, and the first science highlight Dr. Clampin discussed was the Robert J. Collier Trophy awarded to the Webb science team. The Collier Trophy has been marking key achievements in U.S. aerospace and aviation since 1911 and is an important award that speaks to the quality of Webb's work.

Dr. Clampin highlighted recent work from IXPE, which has been mapping out the magnetic field in the Crab Nebula. IXPE is mapping out this new area of science, x-ray polarimetry, which they have not looked at since the first rocket launch more than 20 years ago. One of the Webb's primary science goals is

to understand the reionization of the universe, and the recent results from the JADES survey are allowing them to start to understand reionization.

Dr. Clampin reviewed the FY23 appropriation compared to FY22 and presented highlights of the President's budget. Since they are in the middle of the budget process, there was not much that he could say, although they anticipate belt-tightening going forward.

Dr. Clampin reviewed the Decadal survey suite of missions. The Roman telescope is making great progress as they move forward with the hardware and work to stay on cost and schedule with the mission. Roman is the first large flagship that NASA Astrophysics has ever built to do surveys, so it requires a different approach and a lot more community involvement to make sure that they are doing the right surveys and defining them appropriately, and that they are fully engaged with the science community in working with that data when it is available.

After briefly reviewing mission status, Dr. Clampin highlighted Transiting Exoplanet Survey Satellite (TESS), one of the operating MIDEXs that continues to make amazing progress. The publication count is up to about 1,500 submitted with about 1,400 peer reviewed. Of those, 40 percent are exoplanets and 60 percent are astrophysics. TESS is doing a lot of time domain science, as well as the exoplanet science it was built to do, and shining as both an exoplanet and a Time Domain Astronomy/Multi-Messenger Astrophysics (TDAMM) mission.

Noting that there was a question in the recommendations about maintaining balance between types of projects, Dr. Clampin showed a slide with the number of ongoing current strategic technology projects. The slide showed there was a balance between sensors, which are needed for all kinds of flight programs, the technology associated with the Exoplanet Program Office, which focuses on coronagraphs, Starshade and specialized detector systems, and the technology needed by Astrophysics for x-ray and far-IR and gravitational wave missions. They will continue to try to maintain a balanced portfolio as they do Strategic Astrophysics Technology (SAT) selections. It is important to maintain a balance in technology investments across the community, and some of these investments are very crosscutting across the missions. Dr. Gaskin asked whether the numbers in the chart reflected just those being developed under the Strategic Astrophysics Technology (SAT) and Astrophysics Research and Analysis (APRA) programs, or do they include everything in the portfolio. Dr. Clampin responded that the chart represented the SAT program. It does not represent APRA, which is by design not strategically motivated, but they have the same philosophy for all of the programs and want to continue to maintain a balance. That is also true for the Internal Scientist Funding Model (ISFM) programs, which are funded at NASA centers. If APAC would like a summary, Dr. Clampin can bring one to the next meeting. Dr. Holley-Bockelmann asked if there was a breakdown for the funding or the number of FTEs supported between the three categories on the chart. Dr. Clampin did not have one at hand, but that could be taken as an action for the next meeting when he would bring a fully three-dimensional view of the whole program.

Dr. Clampin provided updates on ongoing and planned Inclusion, Diversity, Equity and Accessibility (IDEA) initiatives focused primarily on the inclusion plans being folded into the Research Opportunities for Space and Earth Science (ROSES) solicitation, new standardized language for ROSES23, and the beginning of Community Days. Dr. Caputo asked what fraction of inclusion plans have been judged as adequate versus inadequate. Dr. Kartik Sheth responded that because it is binary and they are in the pilot phase, 95 to 99 percent were marked inadequate. But that does not mean they were terrible, many of them were actually very good. The process is giving them a chance to engage with all of the awardees. They have done four one-and-a-half-hour workshops where they invited the Principle Investigators (PIs) who received awards and their team members to talk about the lessons learned when they have looked over 500 or 600 of these inclusion plans. Dr. Dominic Benford is going to release the video and the slides from this effort. They encouraged people to come and engage in a discussion and are trying to get them to

spread the word with the rest of the community about the elements of a good inclusion plan. People are asking for examples, but Dr. Sheth said they try hard to not be prescriptive. He hoped they would be invited to the October APAC meeting to present the lessons learned in more detail, and then they will hold workshops at the America Astronomical Society (AAS) meetings. Dr. Antonino (Nino) Cucchiara, Dr. Stefan Immler, and Dr. Sheth are trying incubations with ongoing teams to teach them how to infuse inclusion into existing teams.

Dr. Clampin added that he is really impressed with the way they have approached this work. They are not just dropping a new requirement into ROSES and stepping back, they are working with the community to make sure it is properly integrated and effective, and then taking the lessons learned from the first round back to optimize the program. Kudos to Dr. Sheth and Dr. Immler for doing a great job. Dr. Holley-Bockelmann noted that when she went to the NASA Advisory Council as the APD representative, there was a lot of talk about getting examples, so she appreciates that they are pushing back against that so everyone can build a thoughtful plan themselves. Dr. Sheth added the message they try to tell people is that there is no such thing as an IDEA expert. Everybody is a practitioner at a different place on the journey, and a majority of the creative ideas will actually come from the community. In April 2022, Dr. Sheth did a presentation for the Department of Energy Office of Science, and now every single plan at DOE Office of Science requires a Promoting Inclusive and Equity Research (PIER) plan, which is effectively an inclusion plan. He is also working on an IDEA framework across the U.S. government with seven different agencies.

Dr. Clampin noted that APD has developed a Statement of Principles. Dr. Kiessling asked how it was being implemented and how APD would handle a violation of those principles. Dr. Clampin said it is not a legal document so when issues have come up, they have used it as a place to start the discussion, to talk about their values and how they expect people to behave and work with their teams. Dr. Kiessling said she would feel more comfortable knowing there was a way to enforce those principles.

Dr. Shardha Jogee pointed out that there are a lot of state legislatures that have voted to pull back on all kinds of DEI initiatives. She asked, when one submits a proposal from one of these institutions in the red states, how does one navigate the inclusion plan that they have to write, with their own state regulations? It is a very thorny issue right now for many of the public universities in those states. Dr. Clampin said they will need to look into that more, and Dr. Sheth added there are 20 states that they are tracking and he has shared all of the legislation and where each state is with the team at NASA Astrophysics. Next year there will be different language for the inclusion plan where they double down on the fact that it is a NASA core value. The federal government can often be at odds with state governments, but in order to get federal dollars, the requirements of the federal government must be met. He is happy to talk individually with Dr. Jogee about this topic and could do a dedicated session on this topic at the next APAC meeting. Dr. Jogee said they are continuing the work in her state and suggested that changing the wording to things like “community engagement” and “inclusive STEM communities” without necessarily mentioning DEI allows a lot of freedom. She is happy to talk offline about some of the strategies being discussed.

Dr. Clampin said a few words about the Independent Balloon Program Review. The intent of the review is to be completely open and transparent as they review the balloon program, and he is expecting a final report next March. Dr. Sheth added that it might get delayed. They just had the SGE training the previous day and are kicking off the committee. They hope to publish their timeline and all the nonproprietary data on a web page and then the administrative and fact-finding meetings will be nonpublic. The committee is hoping to have approximately four deliberative meetings where everybody will welcome to come and listen into the committee. A report will be provided approximately a year after they start.

Dr. Clampin then addressed the APAC recommendations from the prior meeting. The first recommendation was to start implementing IDEA discussions and explain how IDEA is being infused into each program that is reported on. They will start doing this for the full meeting and make sure that as they request presentations that they address this requirement.

The second recommendation addressed the naming of flagship missions. As Dr. Clampin stated at a previous meeting, they will follow the recently established process, which is summarized under NPD 7620.1J for naming future flagship missions.

The APAC noted that the Habitable World's Observatory's (HWO) key technical requirements are the ultrastable wavefront sensing and control. Dr. Clampin emphasized that the tens of picometers is over the active control period, whatever that turns out to be, and the need to get to a contrast of 10^{-10}, which is several orders of magnitude better than the current technology. He is trying to line up speakers for the APAC meeting in the fall or next spring to report on where they are with the ultrastable structures and metrology on the telescope side. At least two groups are interested in showing where they are with segmented coronagraphs and the kind of results they are getting in the broadband. He informed the committee of two upcoming meetings, one at the Space Telescope Science Institute in July that will be addressing the science of HWO, but with a day focused on technology, and the other a week-long meeting at the Jet Propulsion Laboratory (JPL) in August focused entirely on the technology for HWO.

APAC also requested information on the current state-of-the-art as far as technological challenges. Dr. Clampin noted that they are currently working on technology roadmaps of both the Exoplanet Exploration Program (ExEP) and Cosmic Origins Program Offices. They have agreed to present them to APAC when they are complete. Mitigation strategies and key decision points will be included in those presentations as it pertains to technology. The part that pertains to the formulation and subsequent implementation of the program is a long way off.

The APAC is looking at the tradeoff between on and off axis coronagraphs in the roadmaps and what demonstrations may or may not need to be done to support future trades of those technologies. At this point, it is premature to talk about the tradeoffs. As the roadmaps come together, they will start reporting to the APAC and as they start doing real technology development, they will be able to talk about some of these trades. Some will not occur officially until the formulation of the mission, which they do not want to start until they know they have technologies that will work together in the system. They will provide regular status reports. Currently they have the funding for the Science Technology Architecture Review Team (START) and support for the Technology Group (TAG) and a very modest level of technology work, so it will be a slow roll for the next couple of years. ‘

Dr. Caputo asked if the strategy for HWO would follow a process similar to the Explorers program, where they would have to be at technical readiness level (TRL) 6 by something like Preliminary Design Review (PDR). Dr. Clampin replied they are trying to get the technologies to around TRL 5 to initiate the start of pre-formulation, which is a Decadal survey recommendation. TRL 6 will probably still be at PDR. For the next few years, the plan is to invest in technology while making sure they have the key technologies to bring it up to a TRL 5 level and then start formulation. There will be an independent review along the way, as the Decadal recommended.

Dr. Kiessling asked that, given the budget pressures and the timing, when will the standing risk review board be stood up. Dr. Clampin said they have been talking with the Exoplanet Program Office and will probably put together a risk review program that is led out of headquarters by Dr. Domagal-Goldman and Ms. Crooke. When they start formulation, they plan to follow one of the key recommendations of the NASA large mission study and not to wait until they are in Phase A to do a Standing Review Board (SRB), but have an SRB stood up as soon as pre-formulation starts.

The APAC's recommendation for implementing the NASA Hubble Fellowship Program (NHFP) will be deferred to the fall meeting when they will have a much better idea of how to move forward with the program in addressing all of the recommendations. Dr. Holley-Bockelmann asked for more information about the delay. Dr. Patricia Knezek told the committee that they have prepared a draft response to the recommendation and given it to their management. Currently, there are budgetary implications and uncertainties, so they want to wait and see how that might impact what they can do when.

Dr. Holley-Bockelmann asked about virtual panels. Dr. Knezek said they have been doing virtual panels for the past few years and plan to continue them. In another three years or so, they will evaluate the effectiveness of the virtual panels and whether they need to make adjustments.

Dr. Clampin continued. The APAC recommended that APD investigate consequences and mitigation for aging instruments/missions that support TDAMM, with an emphasis on Fermi and Swift. Right now, they rely on new, smaller programs that are coming along, such as Pioneers, MIDEXs, etc., that would fill some of the gaps, and they will look at the potential for mitigating aging missions later in the decade. They are not in a position in the current budget environment to look at large missions to replace those two, but a lot of smaller missions can fill some of the gaps quite effectively. Dr. Gaskin commented that the response seems more geared toward an immediate solution versus understanding the trade space and the consequences of losing an instrument in the context of the entire suite. She suggested a future recommendation might be to set up a team to look at the whole trade space and the consequences associated with that. It could be beneficial to the community in terms of planning, even though a lot of these smaller programs fill in the gaps right now. Dr. Clampin said they can look at setting up a team, and Dr. Valerie Connaughton might want to make a comment on that later on.

Dr. Holley-Bockelmann added the point of that recommendation was not to get a solution right now, but to have a process to think about the global ecosystem of the suite in terms of TDAMM and what happens in certain situations. Dr. Caputo noted that some of this planning has to start now. There is a short-term strategy, a long-term strategy, mitigation and consequences, and they should be looking at all of these axes. The smaller programs can fill some gaps in the short term, but as they talk about a long-term budget strategy, she would like to see something turning on in the future. Dr. Clampin said October would be a good time to address how to do that.

For the recommendation to prioritize mission selection as a way of enabling TDAMM science, Dr. Clampin said they intend to prioritize TDAMM as a mission selection goal in any of the coming SMEXs or MIDEXs. He noted they are already investing in analysis tools through the ISFM program with funding for Goddard and Marshall.

The next recommendation concerned the shift to open data and the belief that it can disproportionately affect early career and under-resourced scientists. APAC recommended that information on the length or lack of proprietary time requested be kept confidential from the Time Allocation Committee (TAC). Dr. Eric Smith put the response together: The default exclusive use time for JWST is still 12 months. Users have always been able to request additional time and peers are the best judge of whether that extra time is needed for the investigation. Dr. Holley-Bockelmann said the early career scientists, for example, can be a bit nervous about asking for extra proprietary time because they worry they will be reviewed poorly, so could that information just be made confidential? Dr. Clampin said the dual anonymous review process is confidential and the reviewers do not know the identity of the proposers. Dr. Pascucci said that if someone waives the twelve months proprietary time, that is not confidential. She believes that should be confidential, too, because otherwise a proposal that does not have proprietary time may be favored over another proposal. Dr. Hickox suggested the TAC could be explicitly instructed not to consider that in their evaluations, which they do for other information. Dr. Tremblay noted there are already existing

mechanisms to redact information from the TAC until after their ranked list is created. For example, the TAC is able to see the team expertise list after the rank list is created, so they could also reveal the proprietary time request after the rank list is created.

The APAC asked APD to consider mechanisms to make limited proprietary time models more equitable for early career and under-resourced General Observers (GOs). Dr. Clampin replied that they have to follow the guidance of SMD regarding data access for new missions. Right now, SMD is pursuing open science with a policy to push for a zero proprietary time model for new missions. SMD is interested in hearing any ideas or recommendations the APAC may have and how they could be implemented.

The APAC recommended funding to jointly analyze Euclid, Roman, and Rubin data to maximize the science impact of the three missions, and to build infrastructure to enable time-domain and multimessenger astronomy. Dr. Clampin said they do not have funds to start that kind of activity. Assuming they have sufficient information on the budget at the next meeting, he can show where they are at that point. Dr. Hickox said that the results of the call are not out yet, but he imagines at least some of the Roman preparatory science that was proposed may involve the requested type of funding. So, it may be useful to track what ends up getting funded because some of that may be close to being allocated. Dr. Kiessling added that by NASA not funding this joint Euclid/Roman/Rubin analysis, it may be ceding that science to other countries.

The APAC recommended APD conduct an analysis on how to broaden participation in Euclid science, particularly for marginalized and early career groups. Dr. Clampin said there would be funding for that.

The APAC requested a discussion of the tangible benefits to the Apache and Hawaiian communities for partnering with APD beyond land acknowledgements. Over the last six months they have been focused on Hawaiian community, Dr. Clampin said. They are currently involved in the process of transitioning to the new governance authority, Mauna Kea Stewardship and Oversight Authority, and focused on how to support and engage the Hawaiian community when that transition occurs in a couple of years.

As Roman is being referred to as a TDAMM mission within APD, the APAC would like a conversation on how the project is specifically enabling the aspects of TDAMM that were prioritized by the TDAMM workshop report. Dr. Clampin said they have not yet announced a selection of the proposals, so he cannot get into specific details. Dr. Benford said they are carefully considering the recommendations they saw earlier for TDAMM as a priority for missions in general. For Roman, they are going to try to elevate its utility as a TDAMM mission to include a combination of things like rapid image differencing, transient alerts, tools that would enable photometry and light curves, and classifications of transients, the things they have heard are highest priority for a mission like Roman. They will let the APAC know when they make the announcement public.

The APAC recommended that SMD look for ways to magnify the impact of the Bridge program. Dr. Clampin said they are working with the SMD Bridge program but institutional buy-in comes back to the budget. For now, they are talking about ways to leverage what they do and contribute in constructive ways to what the Bridge program is doing. There are a lot of existing efforts within federal agencies for partnering and inclusion programs, and he is currently talking with the NSF in some detail. Dr. Holley-Bockelmann pushed back by saying both previous two recommendations are ways to help the funding model in that they rely on partnering, which is usually a good way to save resources. Dr. Clampin replied that talk about creating programs with joint activity usually requires a joint commitment of resources. Right now, they are trying to avoid getting into new commitments that they may not be able to support in the future.

Discussion
Dr. Tremblay asked that, given Dr. Clampin's need to seek budgetary pressure relief valves, could he explain his thinking regarding the ones he does not want to touch at all or the ones to go first. For example, would he mount the biggest defense to prevent delays to Roman? Dr. Clampin said his goal is to maximize the science that they can do and make sure they get the maximum community involvement in their programs. Beyond that, it depends on what he is working with.

Dr. Caputo said she noticed the proposal selection rate for the Future Investigators in NASA Earth and Space Science and Technology (FINESST) program is low compared to other programs and the overall amount of money given out is also relatively low. She asked if supporting additional FINESST proposals, and perhaps increasing the selection rate on that particular program, could be an option under the umbrella of promoting inclusivity. It could be a good way to promote inclusivity and support the next generation of NASA scientists. Dr. Clampin replied that for the Research and Analysis (R&A) program, they have looked at selection rates and going forward they will try to address areas where they have a particularly low rate.

Dr. Ho asked which programs are dual anonymous and how have acceptance rates changed among early career and other various groups of people. Dr. Clampin said he would ask Dr. Immler if they can get that data.

Dr. Hickox noted that Dr. Clampin pointed out the two big technological challenges for HWO, coronagraphs and ultrastable optics, in his presentation. There seem to be a number of programs studying coronagraphs, he said, and asked about the framework for ramping that up. Dr. Clampin said that as they start to fund technology for HWO, they will focus on the ultrastable systems and optics at first, and on coronagraphs and detectors the next round. They hope the PI programs for SAT will focus on areas that they are interested in, but they cannot guarantee that. When they move to directed funding for the technology investments, they will be able to focus on the things they need to do this flagship.

Dr. Gaskin asked what the outlook is for the probes since the Explorers are being pushed back.
Dr. Clampin said the probe is one of the three recommendations of the Decadal survey, and they are committed to trying to fulfill the recommendations of the Decadal survey. Right now, the probe is on track, and they are planning to have a call for proposals at the end of July.

Dr. Tremblay noted that NASA is pausing new Athena commitment pending the results of the Science Reformulation Team (SRDT) as moving toward adoption. Are they still committed to doing the cooling chain via Goddard, notionally? Dr. Clampin explained that the European Space Agency (ESA) has embarked on a reformulation of the Athena mission because the cost had gotten extremely high and have asked NASA to reconsider its contributions. Given the current budget, and the fact that ESA are now talking about adoption at the end of 2027, NASA thought it was prudent to slow down the investments in Athena.

Dr. Tremblay asked about the current status of X-Ray Cryogenic Facility (XRCF). Some Heliophysics missions will use it, so how committed is Marshall to keeping it online? Dr. Clampin responded that the level of support for XRCF in the Athena line was significant, so that will go away. NASA is also providing support for the Marshall Astrophysics Division to do work in the XRCF and that will continue. He believes there are still Heliophysics missions that are planning to use XRCF in the future, but as far as the commitment, that is still a question.

Dr. Jogee asked about the proposal acceptance rate for the FINESST program versus the National Science Foundation (NSF) Graduate Research Fellowship Program (GRFB), the two flagship programs for graduate students. Dr. Tremblay said the 2022 acceptance rate was 15 percent and FINESST was 17

percent. Dr. Jogee suggested putting more funding into them, not only because they train NASA scientists, but they also have an outsized influence on the rest of the nation in terms of their graduate student stipend. She supports either increasing the acceptance rate or increasing the stipend level. Also, the NASA FINESST program is the only one that international students can apply to, they are excluded from the NSF program, so it has outsized importance in the graduate student community and science-funding landscape. Dr. Sheth said they looked at whether increasing FINESST funding led to increased diversity of applicants and they did not see it. Dr. Cucchiara is leading an effort to figure out how they can increase NASA's footprint in the community even within the existing budget. Dr. Cucchiara added that the FINESST program is an SMD-wide program, so any change to the language must be agreed upon by all divisions at the same time. But they have looked at the past 50 years of the FINESST and increasing the funding does not lead to a more inclusive environment.

Dr. Pascucci asked that if they know how the success rate differs from division to division. Dr. Immler replied that in terms of the R&A selection rate, they are in a very stable situation right now. The selection rate is about 22 percent for all the R&A programs, but 24 percent on average for the missions' GO/GI programs, and that is caused by a decline in the submission rates for all programs over the past two years except FINESST. They have also seen an increase in the R&A funding line by about 5 percent year. For FINESST, the funding line was about $400,000 at the inception of the program and it has been increased to $2.5 million a year in 2023, yet despite the significant increase in funding, they cannot offset the 20 percent increase in submission rates every year. It varies a little across the SMD divisions, but it is generally low compared to the other R&A programs because of the increase in proposals to the FINESST program. They plan to look at that in depth after the selections this year and it will be studied SMD-wide.

Dr. Holley-Bockelmann asked about the scope and responsibilities of the Euclid NASA Science Center at APAC. Dr. Shahid Habib explained that there are nine nodes for Euclid data and they are maintaining one node in the U.S. that will serve the U.S. community, particularly from a data standpoint. Also, they are developing algorithms for data processing that they provide to Europe for overall data processing. That data center will be there for the life of the Euclid mission, which is predicted to be six years.

Dr. Holley-Bockelmann said the Transform to Open Science (TOPS) program is interested in promoting not only open data, but open science. She asked Dr. Habib if they are receiving any kind of support or communication about making the data not only available but accessible. Dr. Habib explained the Euclid data policy. There will be a limited quick release 14 months after the launch that is 50 square degrees. Another release will come out a few months later, and there will be five or six releases by the time they finish the 15,000 degrees. The data is not open in the beginning. Dr. Holley-Bockelmann noted that it seems like a good synergy to couple the data center with funding from SMD to promote the science, not just the data. Dr. Linda Sparke said that for members of the science community who are not part of the NASA Euclid science team, they will have an opportunity to apply for funding through the Astrophysics Data Analysis Program (ADAP) to do their work. They are not going to make them wait until those data are public. The first call will be early enough that the funding will be in place when the data becomes public. Once the data go public, it will be served out through ESA, and they are thinking about how they get eight petabytes out to the community.

Dr. Holley-Bockelmann asked what partnerships are the missions making with TOPS. Have they gotten any funding, any ideas, any support yet? What is happening with this in a tangible way? Dr. Sparke said there is a lot of preparation, which is important. Things they put in the cloud have to go under a NASA contract and a cloud contract and they need to know which piece of the current infrastructure they can use. Some of the data should be out this year in the Open Data Repository on Amazon Web Services (AWS). They have the data up there but one set has not been checked yet, and for another set they have the documentation so you cannot get it yet.

Dr. Clampin added that each science center is responsible for advertising what they are doing and getting the news out about the particular missions they support. The interaction with the open science in SMD is the long-term trajectory of those science centers, or science archives in this case. The open science team here are talking actively with the science centers about how they make the data available in a cloud-based environment in the future. Some of them have already started moving data to the cloud, and there is also an active discussion going on about how to do cloud-based computing in the future and make it open and available to as many people as possible. Each science center is focused on making sure that the science they are responsible for is advertised and communicated, and people understand how to get the data, what it is, and how to use it.

Dr. Ho asked what data will be available for that 50 square degrees? Dr. Sparke said the Euclid Science Consortium are still working on what they can get ready for that quick data release, but they are not going to slip the timing.

Dr. Hickox wanted to know if there is an explicit discussion going on about how what they learn from Euclid will be incorporated into Roman. Dr. Benford replied that the Science Operations Center doing that for Roman is predominantly at Space Telescope Science Institute (STScI), so the cloud aspect is actually a STScI-managed portion. Even though they are both working with the cloud, they are doing it independently. Dr. Julie McEnery added that some of the aspects of the pipelines at the Infrared Processing and Analysis Center (IPAC) are responsible for leveraging Euclid investments, for example, the spectroscopic pipeline is taking the Euclid pipeline and modifying it for Roman use. So, it will be almost natural to incorporate Euclid lessons-learned because the pipeline is a joint partnership. On the project science, Roman and Euclid have regular meetings and discuss topics like calibration issues or concerns that arise in both places so they do not end up independently trying to solve the same problem twice. There is a lot of communication between the teams.

Dr. Tremblay asked if the members of the upcoming HWO START team are all required to take funding. Dr. Clampin said he does not believe so, but it really depends on their particular institutions.

Dr. Caputo asked how frequently the SAT projects and programs get reevaluated to determine what will be the next strategic projects. Dr. Clampin said that annually or biannually each program office conducts a call for technical priorities, and then they do the selections based on those priorities. The solicitation identifies the technical priorities, but they are community-based. Community input is used to prioritize what the community considers the top priorities.

Dr. Holley-Bockelmann asked about a code of conduct for PIs that have been awarded grants. Dr. Clampin said for those PIs, they are relying on the principles and NASA values.
Dr. Kiessling asked if they would be willing to remove funding from a PI who violated the Statement of Principles. Dr. Clampin said yes, but they would not do that without going through general counsel. Dr. Tremblay added that, as far as he understands, legally they were not allowed to create an APD-wide code of conduct. But APD-sponsored events, such as conferences, can have a code of conduct and that can be enforced. But the statement of principles cannot legally be a code of conduct.

Dr. Holley-Bockelmann noted that they had discussed the idea of a review of PIs for toxic environments and violations of conduct at an earlier APAC meeting. There was talk of having team members who were early career scientists do anonymous reviews of the health and vitality of a mission, group, or PI team. Dr. Clampin said they have not looked this idea, but when they get complaints, they take them seriously.

Roman Update

Dr. McEnery's takeaway message from her presentation on Roman was that they are well underway in assembling and building their flight hardware. The spacecraft bus is sitting in the large Goddard clean

room, and they have integrated over 44 miles of harness, which itself is over 1,000 pounds. The focal plane assembly, a set of 18 detectors that make their iconic logo, has been assembled, completed, and tested. Previously, she had told the APAC that they replaced three of the sensors. An evaluation of the associated Anomaly Review Board (ARB) suggests that they have addressed the problem and are on track for a focal plane that significantly exceeds requirements.

Roman's need date for the coronagraph has been extended to May 15, 2024, which restores the funded schedule margin that will require capability delivery. This puts the appropriate buffers in place to enable the coronagraph instrument to meet its baseline requirements of TTR5. This potentially means that the coronagraph can meet the baseline requirement but left at that it is likely limited to not reaching for ground testing of the goal capabilities.

Dr. McEnery noted that she will discuss Diversity, Equity, Inclusion and Accessibility (DEIA) initiatives throughout her presentation. She reviewed the Core Community Survey Definition and explained that it is important to them that the entire community has a voice in the survey definition process because many distinct communities have a stake in the mission. They are reaching out as broadly as possible and leveraging the advantages they have with multiple science centers, in addition to their own mailing lists. In addition, they are explicitly trying to encourage and enable participation from early career scientists by providing resources for travel support to workshops, and they are proactively reaching out to researchers at undergraduate-serving institutions.

Since Dr. McEnery last addressed the APAC, they have held six virtual sessions, two for each survey, to help people who had written science pitches find each other, work together on common White Papers, and discuss what would be useful in the White Papers. It was an opportunity for the community to have a conversation with each other and with the mission team. The deadline for White Papers was several weeks ago and they had a great response.

Dr. McEnery showed a chart, "Principles in Forming Community Survey Definition Committees," that was part of a presentation shown to the Roman Science Interest Group, which meets approximately monthly. They welcome advice from the APAC and are seeking advice more frequently from their own Roman-specific advisory groups (the Roman Science Interest Group that serves the Roman Project and the Roman Space Telescope Advisory Committee that serves STScI).

They have three core community surveys to address the 2010 Decadal survey science goals. The High Latitude Wide Area Survey is a wide area survey of at least 1,700 square degrees with multiband imaging and slitless spectroscopy. This survey is the only one that does not have time domain in its name, but it does have time domain implications and has the potential to be extremely effective with things that have a very long cadence like high redshift supernovas. The survey also has implications for multimessenger astrophysics since it will provide extraordinary power to look for dual binary active galactic nuclei (AGN). So, there are connections to TDAMM even with that survey. The High Latitude Time Domain Survey is well tuned for time domain astrophysics (such as the supernova cosmology needs that drove its design) and for multimessenger astrophysics. The Galactic Time Domain Survey will probe a different regime in galactic versus extragalactic sources and different cadences. For instance, the Galactic Time Domain Survey can be used as a gravitational wave detector by taking advantage of Roman's excellent astrometry and looking for correlated motion of stars in the Galactic Bulge. General astrophysics surveys have capability but also relevance both for additional time domain-capable surveys and because they can do target of opportunity observations. The bottom line is everything Roman does enables TDAMM. Dr. McEnery pointed out that all of their surveys seem to do all of their science, and they are seeing compelling exoplanet science cases with all three surveys, just as they are with time domain astrophysics.

In a recent talk, Dr. Sam Grunblatt said what JWST is to Hubble, Roman is to Kepler. It is going to be the engine to provide the very large number of exoplanet observations that will enable follow-up by JWST.

Roman's latency requirements are less than 48 hours from the receipt of the relevant data, so that means rectified calibrated images can be seen within two days of the receipt of the data. The system is designed to get them faster, because to meet a requirement of 48 hours it needs to be going much faster on average. Their catalogs and final calibrated data are within six months of receipt of the last relevant data, so things like source catalogs, which include variability information, will arrive on a six-month timescale at the end of whatever relevant survey it is.

Dr. McEnery closed her presentation by reviewing the Roman DEIA initiatives. She showed slides detailing their approach to community engagement, new science teams and community support, engaging with undergraduate-serving institutions, and three opportunities that were available in recent solicitations (Wide-Field Instrument (WFI) Science, WFI Project Infrastructure Teams, and the Coronagraph Community Participation Program). In summary, Dr. McEnery said participation in and leadership of science collaborations and technical working groups is independent of whether or not a person has been selected for NASA funding. That funding is separate from science and technical engagement. In closing, she reminded the committee that Roman remains within its cost and schedule targets.

Dr. Benford added that in their recent approach to solicitation an inclusion plan had to be provided along with each proposal, and all were deemed inadequate. So, they all are going to have to write a more complete inclusion plan and submit it before they receive their funding.

Great Observatories Maturation Program

Dr. Shawn Domagal-Goldman, the program scientist for the Great Observatories Maturation Program (GOMAP), began the presentation. The first GOMAP mission, the HWO, will be inspired by Hubble. It has a similar wavelength range and will have some similar science cases but will go further in some of those science cases, including understanding the lifecycle of galaxies with the ultraviolet to near-IR wavelength range but with a bigger aperture. With the larger aperture it will have capabilities to do some great spatial resolution imaging, for example, of individual stars and distant galaxies.

He showed an image of the kind of science data they plan to connect to that biosignature science case. They want to block out the starlight from one of the stars in the stellar neighborhood so they can directly image a planet in the habitable zone around that star, and then spread that reflected light out into a spectrum and analyze those spectra for signs of specific gases that might indicate habitability and/or life. That same capability of collecting spectra of planets orbiting other stars is also going to bring a bounty of information on the diversity of planets that exist beyond our solar system. "Habitable worlds" is the leading tagline in the name, but the scientific revolution may come from the diversity of planets they observe and the information they get on how planets work and how weird our own solar system may be.

This mission, like the other flagship missions, is ambitious and will push the limits of what can be done technologically. We need to develop those technologies early so that when they enter the parts of the mission where the costs and the staff ramp up, we know what they are doing and have projectable budget and schedule for those missions. He believes our plan is consistent with recommendations that can reduce the chances of going over cost or over schedule. We are at a very early stage where we are coming up with plans for how to implement the technology development, scope definition, and other recommendations early on so they understand how difficult it will be. As the mission matures, we will have a better understanding of the associated cost and schedule according to that difficulty once they enter the formalized pre-Phase A and Phase A parts of the mission. Based on the Decadal timeline, they are where we should be — focused on the first observatory in GOMAP, HWO. Activities on future great observatories (FGOs) 2 and 3 come later in their timeline.

He reviewed their big picture strategy, which includes an aggressive early technology development program and the next generation rockets that will allow them to have fewer folds in the primary mirror potentially, more mass and volume for the primary mirror and the whole observatory to fit in, and more trade space for the massive volume. Next generation rockets are also bringing launch costs down.

He introduced Concept Maturity Levels (CML), a concept that JPL has been developing to talk about how mature a whole concept is, not just the technologies, but also how those technologies fold into that interrelated space. Their goal is to be solidly at Concept Maturity Level 3 by the time they spin up a pre-Phase A formal project office. We want to fully study the trade space and make sure they understand our options and have that documented so that when the pre-Phase A project office spins up, they can make well-informed decisions as quickly as possible.

A Science Technology Architecture Review Team (START) is the first HWO team NASA is spinning up. The START will be looking at going from the science in the Decadal survey to the different performance options they want to have on the table for HWO. He noted that this is not a linear process, it is iterative.

Dr. Hickox said that in recommending HWO, they made a lot of connections between the science and the mission capability very explicit. Is the activity of the START largely focused on reassessing that or is it looking at new things that may have come along in the last two years? Dr. Domagal-Goldman answered yes. He thinks they could still go in the other direction from the missions back to the science, which may be consistent with the science traceability matrices in those precursor studies. Science numbers or their understanding of the uncertainties has improved in the past few years, even if the uncertainties have not gone down. Other things have changed with the landscape that they are doing this in, in particular, the serviceability part. One change is they have folded serviceability into the precursor studies at a level of making sure the right knobs, etc., were included in the designs. They are not to the level of what serviceable means for the first generation set of instruments versus the second generation. They did not treat serviceability as something that was inherently part of the plan and tactical, it was just something they wanted to make sure was possible. Also, they received a bit more guidance on the overall strategy they want to execute the mission, partially from the top-level GOMAP recommendation in the Decadal and other independent reports.

Ms. Crooke added Astro2020 recommended HWO can address two-thirds of the science goals that it laid out. Only one of them was quantitative; the rest were qualitative. NASA wants the START to drill down to understand what observational qualities that HWO needs. What are the observations, what are the instrumental capabilities needed to achieve each and every science objective, and where are their breakpoints? Then the START will be able to come up with a Venn diagram to show the observational qualities that naturally come together and look at the outliers of the other science objectives from Astro2020.

The program had a call through a Dear Colleague letter for people to self-nominate to the START and 176 people self-nominated to be members and 31 people self-nominated to be cochairs for the START. They were hoping to have cochairs selected and ready to be announced by early July. The selection committee at NASA headquarters is composed of a diverse group of people from different demographic backgrounds inside APD, and they represent the different science areas APD has under its purview. They have been asked to look at objective criteria in two ways. The first is the bandpass criteria that differs for the members and the co-chairs in terms of expertise in technical areas related to HWO, a commitment to abide by the APD statement of principles, and their willingness to participate in team-based activities and advance IDEA initiatives associated with HWO and GOMAP. For those under consideration, there is a separate set of objective criteria of capabilities the team needs to fill. First, there are the technical capabilities, the full set of science and engineering things they want to consider. They also want the group

to interface with the community and be representative of the community, both in terms of the types of expertise on the START, but also the demographic backgrounds of the people on the START and the institutions and types of institutions they represent.

Dr. Tremblay pointed out that built into the START Terms of Reference was a mechanism by which START members could mentor an early-career person. He asked if that early-career person would also be part of the START or external. Ms. Crooke said they would be external. Once they figure out the subject matter expertise goals, they want to bring in the Program Analysis Groups (PAGs). They intentionally want to target R2s and small colleges. Dr. Domagal-Goldman added that for people who do not end up on the START, they are going to encourage the START cochairs to open up their meetings as much as possible. One of their responsibilities is to connect to the community that is not on the START, focusing on early career people.

The START will work closely with the Technical Assessment Group (TAG), which will be made up of people from NASA (ARC, GSFC, and MSFC) and JPL. The TAG will be looking at design options and technology development and roadmapping strategies. The START and the TAG combined will have a lot of subject matter expertise holes, so the TAG's main function will be to help bring in the rest of the community. The best way to do that at this early stage is to have a NASA-only group help the program and APD understand the things they need to prioritize bringing external partners in to do. The program will work very closely with the PAGs and other community working groups and there probably be a is aiming to have a ROSES call. Dr. Domagal-Goldman will generally be working with the START while Ms. Crooke will be working with the TAG.

An idea from Astro 2020 was to start looking at concept studies in the second half of this decade when HWO moves into its formalized Pre-Phase A project phase. For the Astro 2030 Decadal era, Ms. Crooke and Dr. Domagal-Goldman want to be sure that those concepts are ready. In other words, the technologies need to be developed as much as possible so they can have a projectable cost and schedule that avoids cost and schedule overruns on HWO and sets them on a path for better cost and schedule performance on large missions going forward.

The group spent several minutes trying to clarify aspects of the timeline chart in the presentation before Dr. Domagal-Goldman said their end goal for HWO this decade is to get through an independent review that makes a recommendation to proceed. Their plan for HWO and GOMAP now is to get the technologies to TRL 5. The focus on HWO is consistent with the Astro 2020 recommendation, and they plan to implement the other parts of the recommendation later this decade. Once they know more about the budget they can expect, they can create an APD, NASA, or GOMAP version of a timeline for the decade. The ideal would be to have enough funding to have the technologies developed for two other missions by the end of the decade.

Dr. Tremblay asked if the current dream scenario, amid immense budgetary uncertainties, is to get HWO past KDPA before Astro2030 and to have a re-spun up Lynx-like and Origins-like concept study as input to Astro2030. Dr. Domagal-Goldman said yes. If they do the things they talked about for the early development for HWO now, according to research, HWO should be more likely to come in on budget and on schedule. If the early development of HWO is done correctly, it is going to make the eventual launch date of 2 or 3, whichever one it is, more likely to happen sooner.

Dr. Clampin added that right now his priority is to get the first mission to the end of the decade, get it through its review as the Decadal specified, and continue talking to stakeholders about that mission. The additional investments and concept studies that are recommended toward the end of the decade can be addressed as the budget allows.

Dr. Caputo said it looks like either the x-ray or Far-IR will go forward as a probe. From a big science perspective, it seems challenging because they will not have results from either of the probes when they think about the next flagship. If they are going forward with the probes, the timing is very awkward for planning an x-ray observatory. Dr. Domagal-Goldman said if they were doing those studies now, they would look at not only the science context of what is operating today, but also what the anticipated set of capabilities might be at that time.

Dr. Caputo commented on the fact that in the last Decadal survey a gamma-ray flagship was specifically not included as part of the concept studies, and she hopes that mistake is not repeated in the next Decadal survey. Dr. Clampin said the mid-decadal could weigh in on it, but the study is conducted by the National Academy and they take input. For the next Decadal survey in 2030, the gamma-ray community will need to make a strong case.

Dr. Gaskin would like to see an updated chart that reflected reality on how the program is being implemented. Seeing more detail on the HWO line, the first blue line, would also be helpful. She would like to see a plan for how to integrate those two communities into all HWO activities and how to best integrate and ramp up other communities into the process for the first HWO. Dr. Domagal-Goldman said they need more budget certainty before they can build the timeline out. They are open to suggestions about the best ways to integrate the communities.
Dr. Domagal-Goldman ended the presentation by emphasizing that they really want people involved, even if they are not part of the START. There are other ways for people to get involved through community endeavors and calls. Regarding IDEA, they wanted to make sure IDEA was emphasized in people's self-nomination letters, so they requested this input in individual Dear Colleague letters. He was happy to report that all of the cochairs' self-nominations had an extensive discussion of IDEA, and he is optimistic that they will have leads who will take it seriously. Going forward, they are going to work with those co-leads and START to make sure that the implementation of IDEA is done in a meaningful way. Long term, they want to have conversations about the project's culture so that IDEA is implemented on the project in a way that serves the community.

Discussion
All discussion was included in the section above.

Time Domain Multi-Messenger Astronomy
Dr. Valerie Connaughton discussed some of the activities that took place following the Annapolis workshop, including a special issue on TDAMM in *Frontiers in Astronomy and Space Sciences,* and announced that a follow-up workshop will be held in Tucson in October.

She noted that her presentation did not address IDEA in their initiatives, but said it is very clear that TDAMM is an area ripe for IDEA initiatives. The barriers to participation in TDAMM science are fairly low, and infrastructure is very important in ensuring that these barriers are further reduced. So their brief to the organizers of the upcoming workshop was to make sure the SOC reflected the community as a whole, because the questions of infrastructure look very different depending on whether one is at a government lab, the NOIRLAB institution, or a less resource-intensive institution.

Dr. Caputo noted that the Windows on the World workshop overlaps with the IceCube collaboration meeting. Dr. Connaughton said perhaps there will be a way to split the IceCube community so that it receives appropriate attention and representation at Windows on the World.

LVK O4 kicked off in May. They are excited about future observations of mergers and compact objects that could have electromagnetic counterparts that can be observed with NASA missions. It is an important test case of implementing some of the findings from the study that the Physics of the Cosmos (PhysCOS)

program is undertaking of their current missions: TDAMM observations, how they perform observations, how they support the community, the barriers that occur, the challenges. The PhysCOS team are writing their report and plan to undertake a pilot of the recommendations they come up with in connection with the Laser Interferometer Gravitational-Wave Observatory (LIGO) O4 run.

To select U.S.-based scientists to join the ULTRASAT Science Working Groups as part of the ULTRASAT Science Team, they ran a ROSES 22 call and laid the selection criteria out in the solicitation. The main criteria were that the science the investigators were proposing had to be achievable and within the capabilities and observing strategy of ULTRASAT without any major modifications. The proposals had to show an awareness that ULTRASAT is a wide-field survey mission with no spectral resolution. The second criteria was that the science had to be done within the framework of the ULTRASAT Science Working Group. Part of that second criteria meant that the proposals had to show a plan for what they will be doing for the two-and-a-half years before the launch and what their three-year term as ULTRASAT participating scientists would involve. They made offers to 14 scientists and are very close to making an announcement of who those 14 scientists are. In addition to the excellent work done by the review panels, who considered the ULTRASAT-specific criteria very carefully in their evaluations, they selected a slate that shows very broad scientific breadth across the 14 ULTRASAT science working groups and also considered career stage and institutional diversity in selecting the scientists.

Dr. Connaughton noted that there are very different views of what TDAMM is, so she does not define TDAMM. A lot of their community initiatives, particularly the cross-PAG activities, make very clear that in their three programs there is a lot of interest and involvement in TDAMM science. ASTRO 2020's recommendations for NASA regarding TDAMM where about realizing and sustaining a fleet of missions that observe time varying and transient phenomena and counterparts to potential multimessenger phenomena and electromagnetic counterparts. "Realizing" means new missions. "Sustaining" means making sure that you always have a pipeline of missions that are available to answer this key science, but it also means sustaining the ones that you have, including maintaining and replacing workhorse missions that have contributed much to TDAMM science.

The workhorses are wide-field monitors that are either looking for things that change in order to initiate follow-up observations from pointed telescopes, or they are monitoring the sky so that if another mission, perhaps a multimessenger mission, a neutrino, or a gravitational wave experiment sees something, they have the capability to say what the NASA missions, at any wavelength, saw at the time the other interesting phenomenon happened. In addition, there a workhorses that are follow-up missions. Swift is both a monitor and a workhorse follow-up telescope that slews automatically to make x-ray and UV observations of things that are interesting in the TDAMM and other worlds.

APD is collecting information and coming up with ways they can do things more efficiently, both for the missions and for the observers who are writing proposals or requesting observations in the area of TDAMM. That report will be out later this year. They are undertaking a pilot in connection with LVK to see how the fleet is performing and how things can be done better. Also, they are working to make sure the infrastructure in which the workhorses operate is healthy.

Dr. Connaughton noted that they are doing what they can within the fiscal constraints under which they operate. There is already a very capable fleet and they have new missions that address some of the key questions of Astro 2020. For example, a more sensitive gamma-ray monitor is already being planned with the Pioneer Starburst Mission. UV capability for multimessenger follow-up is addressed through participation in ULTRSAT. These may be seen to be reactive, but they are already addressing these very important questions with the program of record. They are looking to their TDAMM White Paper and the follow-up volume to lay out the open science questions that the next generation workhorses need to consider most urgently. Fermi, GBM, and Swift are fantastic workhorses but they were designed for

earlier questions of TDAMM science. For the most pressing open TDAMM science questions now do they really need a 30-second response time for an x-ray counterpart? Are other things more important?

Dr. Connaughton provided updates to the infrastructure issues and community events that she had discussed at the March APAC meeting. The Terms of Reference for a new TDAMM SIG was in the committee's meeting packet. PhysPAG is open to APAC's input and suggestions.

Discussion

Dr. Nikzad asked Dr. Connaughton to comment on UVEX in the TDAMM landscape compared to ULTRASAT. Dr. Connaughton said they are very different. UVEX has a broad stellar science component and exquisite spectral capability to probe that science, whereas ULTRASAT is a wide-field monitor that is looking for things in a single energy band that are varying over time. The need for a workhorse monitor, meaning monitoring the broad sky, will be partly addressed by their participation in ULTRASAT, but it is not all they need to do UV science.

Dr. Hickox noted that TDAMM is such a multifaceted and broad area and there are so many different inputs that it would be helpful to the community to see a broad schematic of the different missions, their timelines, and broadly, their capabilities. Dr. Connaughton said the best schematic she has seen was given by Alison Jones in a post-talk on the COSI team. She concentrated on the high-energy coverage and the different missions and their timelines.

Dr. Connaughton made the point that when they are considering what they are doing and where the gaps are, they need to remember that there are international missions that are complementing or picking up the work of NASA workhorses. The French-Chinese mission SVOM, which will be launching next year, has very similar capabilities to Swift. Other concepts are being proposed in India, Japan, and other countries. They should not assume the burden for being the sole workhorse of the world is within NASA. She suggested that the graphic Dr. Hickox asked about should include the NASA fleet and programs of record, along with what other countries are doing. It would need to be updated frequently.

Dr. Caputo was hoping to see more long-term strategy and strategic thinking for TDAMM from NASA. She appreciates the investments in current infrastructure and smaller scale missions, but for some of the smaller scale missions, their lifetime could end before Fermi is finished. She would like to see a plan for a strategic mission dedicated to addressing the holes that are going to happen in their wavelength coverage, for example, a Far-IR x-ray probe mission that is part of the funding wedge for TDAMM as recommended by the Decadal survey. Dr. Connaughton said she does not know what a TDAMM mission is because she does not know what science questions a TDAMM mission is supposed to address. She knows what a TDAMM fleet looks like. They are developing plans to be more strategic but does not think it is possible to define a TDAMM strategic mission in the same way it is for a Far-IR probe. With the workshop and follow-up papers, and in their community effort they have made the first step to identify the key science questions that NASA has to address. Those questions are the things that are ultimately going to drive the types of missions that, when the fiscal climate allows it, they will be able to develop. Dr. Caputo said that the missions that are going forward are not going to meet all the capabilities that Fermi and Swift have. The TDAMM community has broad, diverse needs, but the same is true for the exoplanet community and they have been able to identify a mission. They will continue to have the workshops so the community can define what it needs, but she needs to see at some point that the funding is going to turn on and those needs can be met. Dr. Connaughton said that she hopes the workshops and White Papers will give NASA a feeling for what their roadmap looks like. What does the future TDAMM fleet look like? Is it a single flagship mission? Is it a suite of missions? Is it different wavelength coverages, different strategies for monitors and follow-ups? Their strategic response depends on the answer to those questions and whether the budget allows it. Dr. Caputo mentioned that she has also not

heard of a long-term strategy globally. Is NASA and the U.S. ceding leadership in this area of science to other countries?

Dr. Pascucci asked, "Since the Astro 2020 recommendations are narrow and focused on multimessenger science, does it mean that time domain-only is not considered?" Dr. Connaughton said they are focused on space, electromagnetic observations of time varying and transient phenomena, and possible counterparts to multimessenger. It is not everything that is multimessenger and it is not multimessenger observations themselves. It is electromagnetic. Even though the multimessenger aspects, the cosmic ray, or the gravitational wave aspects themselves are TDAMM science, they are not part of the recommendations of Astro 2020.

Dr. Holley-Bockelmann asked what they expect in the next five years as far the ecosystem for TDAMM, not just for NASA, but the global community. She suggested that taking stock and creating a time domain census of their capabilities would be helpful as a starting point since it could point out where there are holes. APAC is not asking for one particular mission, but with full cognizance that multimessenger and time domain imply several different types of messengers together, they need to have a census so they can understand what kind of science could they expect to lose given that they expect a hole in a waveband in the late 2020s. Dr. Connaughton replied that there are Explorer calls all the time so they do not know any more than APAC about what future missions are going to do to TDAMM. As an exercise, producing a census may be helpful, but the holes may be things that are not as important to answer the future questions as the things that they have now. She feels they are being asked to produce something that assumes that TDAMM needs are static, that the questions that are interesting now are going to be the ones that drive TDAMM science in 2030. It could be that some phenomenon that Rubin uncovers suggests that they need some wavelength coverage in a monitor that they completely lack and do not know is important. Dr. Holley-Bockelmann said there will be Explorer calls, and they may not be prescribed in a certain wavelength band, but there will be a capability that may be able to respond to the hottest science that happens as a result of Rubin and Roman.

Dr. Hickox said a key point is that there is a long-term plan to go forward with strategic x-ray and infrared observatories if the funding is available. There is not a similar plan for electromagnetic observatories, but there are smaller scale opportunities that would come up along the way. He wondered whether those would be sufficient in the changing landscape they see in TDAMM.

Dr. Clampin suggested that Dr. Connaughton and he take an action for the next APAC to put together a summary of the fleet and what they know of other agencies, the mission environment now and in the future, and potential collaborations that may come along. Potential gaps can be addressed at the next meeting. He also noted that the Decadal did not ask NASA to focus on a strategic TDAMM mission. They were fairly specific about how they wanted TDAMM science addressed. TDAMM is not being emphasized in mission calls, but that does not stop people from proposing TDAMM missions. He also reiterated that they were not going to factor in TDAMM as a downselect criterion for current or future SMEX and MIDEX calls.

Dr. Kiessling asked about the funding for the 14 science members that NASA selected for ULTRASAT. Dr. Connaughton explained that the top ten slots were awarded with a limited funding level from NASA. The other four people will have to look for funding elsewhere, so perhaps they incorporate their ULTRASAT-specific work with their existing duties or look for funding from NSF or some other source of startup funding. The first eight slots were awarded to NASA in return for NASA giving ULTRASAT the launch. The following six slots were negotiated by the Rubin team, and they were so good at negotiating that they got more slots than those for which NASA had funding.

Fermi Update

Dr. Elizabeth Hays began her update on the Fermi mission with a review of what Fermi is. It is very much a monitor, but it is also doing important survey science. For this reason, it was built from the ground up to be an observatory. Fermi is a community survey mission and community involvement is very central to the mission and its science. The data is available publicly immediately after processing, and there is no proprietary data.

Their guest investigator program is not for time, it is for support, analysis, and theory. It often generates ideas and algorithms, the kind of protowork that then rolls into things that the science support center or the teams can take up, work with, and deliver to everyone. A whole ecosystem has been built up to enable all of this science.

Fermi has achieved its goal of bringing a new view of the energetic universe and unveiled the gamma sky, which was mostly unknown before Fermi. A couple of examples of these discoveries are gravitational waves and light and the Fermi bubbles, which are driving a lot of science investigations to understand what happened in our galaxy a few million years ago. The gamma ray bursts are one of the strongest examples of the really energetic, intense activity going on in the universe.

Dr. Hays reviewed some of their game-changing gamma-ray burst observations. One of the things they learned from Fermi and other observations is that gamma-ray bursts can no longer only be categorized by their duration. Now they talk about the origins and progenitors in context with how they developed and how they can understand the science. One burst, 2011211A, was important because there is a measurement of the kilonova identifying this longer duration burst as the neutron star merger. There was a gamma-ray afterglow detected by the Large Area Telescope hours after the trigger, long enough to look for the interaction of the jet with the kilonova itself, which is also a very unique measurement.

One of the things that Fermi was launched to do was explore the origins of cosmic rays. Where there are cosmic rays, you expect gamma-rays and neutrinos. So the connection between gamma-rays and neutrinos is fundamental. The processes that produce neutrinos also produce gamma-rays. The recent measurement that Dr. Hays found interesting is not just the counterpart searches but, in one case, the gamma-ray blazer was associated with a neutrino event. It was the first time they did that with a source that can be identified with a high energy neutrino. Another source has emerged in the last year, NGC 1068, which is aluminous Seyfert II galaxy. It is the most luminous one that has been detected by the Large Area Telescope.

The other really interesting science topic they look at, important to time domain multimessenger, is supermassive black hole binaries. Because of the all-sky survey, they get incredible mission link light curves that do not have gaps, down to very short timescales. She showed a slide with a massive black hole binary candidate showing about a two-year quasiperiodicity that they have seen for a number of cycles now. They have to be very careful with these measurements because they can get pulled by noise, but with 15 years to track this behavior, binaries on these yearly timescales start to emerge. They also have 15 years of observations of millisecond pulsars. In many cases, the Fermi observations led to discovering the millisecond pulsars used in pulsar timing arrays.

Dr. Hays talked about several Fermi Science Center highlights, most notably the GI Program Cycle 16 starts in August and the award selections were announced in May. Data software and catalogs continue to come out frequently. In the last few years they put out a LAT light curve repository with full-scale mission light curves on several cadences for around 1,500 sources that are variable in Fermi, and the methodology has also been published.

The Fermi team continues to talk to the community about what they need to analyze the data. They held a community workshop that was organized by fermipy developers who built a community tool to work with the LAT Data Tools and that was held at the Stanford Linear Accelerator Center (SLAC) in January.

After some highlights of the Guest Investigator (GI) Program, Dr. Hays reminded the committee that because they are not assigning time, the funding for this program is going for analysis of the instrument data, for joint observations needed to understand the data, for complementary theoretical studies, and for analysis methodology. They have seen a growing need for this methodology, and the GI program is actually playing a role in people developing tools that they then share back with the community

Fermi Gamma-ray Summer School is one of their leading community events because they get to introduce early career scientists to Gamma-ray techniques and teach them how to collaborate. This event is smaller scale and very tightly knit, and they show participants how to become a collaborator, work together, and learn from each other.

One of Fermi's IDEA highlights is a mentoring program that arose out of discussions within the Large Area Telescope collaboration and now also incorporates the Gamma-ray Burst Monitor Team. The idea came out of discussions with the early career scientists about the things they wanted that they were not getting. The mentees can list some things that they would like to be mentored and they are matched with a mentor the meets their preferences related to background, language, and geographical locations.

Overall, the observatory is working really well. They experienced a single failure through the mission — one of the solar arrays drives no longer rotates. It has had a pretty minimal impact on the observations of the science. The rest of the instrument components are all undergoing very gradual degradations that can be managed. The communications outlook may be most limited because they are completely dependent on TDRS for the data. They have noticed in near term, just because of the loss of the Guam station, they have had a drop in the reliability of their real time notices. Those impacts can be mitigated to some extent by doing a lot of manual scheduling.

Of the Fermi TDAMM capabilities, one of the most important is that Fermi is in a unique and highly dynamic energy range. Most important is that the sensitivity reaches beyond the outliers and the populations they are looking at. That means that they see the rare event, but also can put it in context with things that are going on commonly. That has been very important for advancing the science for the parts of Fermi that are concentrating on transient variable sources.

Dr. Holley-Bockelmann asked about the increase in pipeline capabilities and if there has been an increase in cost or FTEs now that they are responding to much more science. Dr. Hays said they built up over time, but it is part of what they deliver from the mission. When they do their Senior Review proposals, they show what they are proposing and the things they can provide the community, then find out if they want it. They are already running substantial processing just to get the LAT data, so adding something on top of that is much simpler because they have the infrastructure to run a substantial computing cluster out of Slack and they are maintaining it. And so doing things on top of that is very efficient.

Dr. Holley-Bockelmann asked her about the Tracking and Data Relay Satellite (TDRSS) limitations. Dr. Hays replied that they cannot change the radio or the waveband they use to downlink their data. She could not say what the TDRSS plans are but, in the observatory, as long as they have service in the bands that they need, they can do that.

Dr. Hickox asked if they have any lessons learned or tips for doing the summer schools based on what they have learned over the years. Dr. Hays suggested that he come and talk to them because they all are unique events depending on the goals for the event and what resources they have with their partners. Dr.

Amy Furniss put the imposter syndrome workshop together and she has a starter package that someone can use to figure out what to do. Dr. Holley-Bockelmann asked if they have followed up with or tracked the participants long term. Dr. Hays said a lot of their participants are working on finishing up their degrees and getting their publications out, so she did little study a few years ago. Two years after the school, about 80 percent of them had papers out on the things they had been talking about at the school.

Swift Update

Dr. Brad Cenko began his presentation with a brief status update on Swift. In the past few years, the19-year-old mission has seen a growing number of hardware issues, none of which have damaged the mission significantly. After an overview of the mission, he highlighted five unique contributions that Swift provides to the NASA portfolio:

Prompt multi-wavelength follow-up. When an interesting source is discovered by a ground-based facility or another space-based facility, Swift can provide UV and x-ray observations relatively quickly.

Precise gamma-ray burst localization. Swift can localize gamma-ray bursts to a size on the sky of about three arc minutes, which is well suited to the vast majority of instruments on the ground and in space. Because it rapidly slews its x-ray telescope and detects the x-ray afterglow, you get an arcsecond-level position for more than 90 percent of the burst that it finds. A large community uses ground-based or space-based facilities to promptly follow up Swift discoveries at optical, near-IR, radio, and x-ray wavelengths to fully characterize the gamma-ray burst (GRB) afterglow phenomena.

Multi-wavelength monitoring. With its prompt slewing capability, Swift can relatively easily take short observations of a large number of targets each orbit. Even though it is in a low Earth orbit, it can achieve a high observing efficiency of 72 to 73 percent over multiple decades, allowing for sustained observations of variable AGN and stars.

Mission synergies. Swift's ground system interacts and forms synergies with all of the other missions in the NASA portfolio. With NICER, they conduct joint x-ray observations. With NuSTAR, they provide the soft x-ray coverage for every target that NuSTAR looks at to give broader x-ray wavelength coverage. With TESS, they are looking at outbursting stars to measure the impact of these high energy flares on the atmospheres of the exoplanets around their stars. The ground systems' dynamic scheduling and nimble observatory allow them to interact and interface with the entire astrophysics portfolio.

Hard x-ray sky survey. Due to the very large field of view, when it is not detecting GRBs, it is still collecting useful high energy data, which provides a hard x-ray sky survey that is more than 30 times more sensitive than the most sensitive previous all-sky survey at these wavelengths. That has led to some interesting results when looking at AGN in the nearby universe.

Their scientific priorities for the next few years include realizing the promise of multimessenger astrophysics and, with the existing and new wide-field surveys, the capability to conduct rapid response x-ray and UV follow-up will continue to grow and lead to new and exciting science.

A key part of enabling that science is the guest investigator program. About 25 percent of Swift time is given out through this process, which is a critical component of community input for the Swift observing program. Their oversubscription factor is in between 3 and 4 to 1, so they are competitive.

Dr. Cenko reviewed several IDEA activities for Swift. Because the bar for getting Swift data is relatively low and it is easy to ask for small amounts of data and for modest-scale programs, they have the data to show that Swift has been a very important component in the NASA portfolio for bringing new early career researchers into UV and x-ray astronomy, in particular. If NASA wants to make sure that future

Chandra users, or the x-ray flagship that comes next, represent the broad community, they have to make sure that they are doing that on Swift. They are working hard to get as diverse a pool of applicants and users as they can, and they have tried to broaden the pool of people who win their GI proposals. In the past, a lot of repeat institutions and individual proposers were successful, but since dual anonymous was implemented the percent of people who are first time proposers has increased appreciably.

He mentioned one stumbling block and a request for APAC: In their 2020 Senior Review, they requested a modest amount of overguide funding to hire an IDEA consultant to be shared between GSFC missions. If they work collectively, they have a broad scope and can reach a broad range of the astrophysics community. The report came out roughly a year ago, and they still have not been told whether it has been funded by the APD. They would appreciate getting clarity on the issue and asked if APAC could help accelerate the process.

Dr. Cenko then focused on how Swift can interplay better with the rest of the missions in the NASA portfolio. They have worked on continuous forward commanding, the capability to always have a channel to uplink a request to the spacecraft, and by working with
NASA space communications team, they put it in place. Now, about 85 to 90 percent of the time they have continuous availability up to the spacecraft to uplink rapid response to gravitational wave alerts, fast radio bursts, supernovae, etc. They are participating in an O4 pilot study between the x-ray observatories to do globally optimized follow-up across the different NASA assets to capitalize on the unique things that each individual observatory can provide.

Swift's expected reentry is sometime in the middle of the next decade. Dr. Cenko detailed several of its hardware issues, which have been increasing, and conveyed a sense of urgency that Swift is starting to show its age. He summarized the presentations by saying they need to look at what they can do to provide capabilities that will minimize the gap between when Swift and Fermi are no longer operating. Because of the time it takes for missions to be developed, approved, and built, he is not sure they will have continuous access to a lot of Swift's capabilities. For now, Swift will continue to do great science, but if the community wants to maintain similar capabilities, let alone get new ones going forward, it has to move quickly.

Dr. Tremblay asked how long they will have continuous uplink capability, how long is the run, what did they pay for it, and how did they get that time from TDRSS? Dr. Cenko said they have been promised the capability through the duration of the O4 run, approximately the end of 2024, but they are interested in continuing it afterwards. Because it is a NASA asset, the project does not pay anything for it, but that does not mean there is no cost to NASA. He said this means that TDRSS has unused capability and that people should think about how to make use of it.

Dr. Holley-Bockelmann noted that they have five Targets of Opportunity (ToOs) a day but when Rubin arrives they expect a lot more. Are they prepared for that and what do they have to do to get ready? Dr. Cenko said they are working to move to more fully automated operations where they define programs they want to execute in advance, preapprove people to submit ToO requests when certain criteria are met, and have automatically scheduled uplinks. Their Science Operations Center at Penn State has developed a new API to allow people to submit a ToO request to Swift automatically from a computer. They will need to get input from the community about the compelling science cases and criteria they should be using to identify things they want a prompt follow-up for. On the back end, they will make use of tools they have developed to do it in a more automated way.

<u>NuSTAR Update</u>
Dr. Brian Grefenstette gave the committee a status update on NuSTAR focused on the TDAMM prompts, science highlights, their IDEA responses, and a look into the future focused on the hard x-rays. NuSTAR

just celebrated its 11th year in space. NuSTAR looks at the most energetic sources of the universe and some of the high energy electrons being produced by those sources The result is that there are no standard candles in the x-ray sky. They have always been thinking about the x-ray sky as highly time variable and highly dynamic. When NuSTAR first launched they expected to do about two ToO observations per year, and they now average one or two per week.

NuSTAR is the only NASA focusing hard x-ray telescope that covers up to 79 keV, so it can get into some of the highest energy photons coming in from the energetic sky. It is two coaligned x-ray telescopes, each one is basically identical to two optics focusing down on two hard x-ray detectors. It has a relatively narrow field of view, about 12 arc minutes outside and roughly one arc minute HPD imaging. It is in low earth orbit about 600km up, with about a six-degree inclination.

As far as NuSTAR and time domain, NuSTAR is an incredibly flexible observatory both in schedule and field of regard. It can look anywhere in the sky and is the only focusing hard x-ray observatory in space right now that can look at the sun.

Their only concern programmatically for time domain science is that about 50 percent of the time NuSTAR is observing in coordination with another mission, not including the observations with Swift done on a routine basis, and that number is increasing. When they are doing these observations, typically the other observatory is more constrained, and when they are observing with XMM they usually cannot interrupt that observation to look at something else. They have to wait for those observations to finish before NuSTAR can actually go observe, especially if it is a community driven ToO. If it is a Guest Observer (GO) ToO program, they can interrupt the ongoing observation if it is a high priority ToO.

NuSTAR is operating very well but it is well beyond the design lifetime. There has been no degradation to its overall sensitivity or operational capabilities. The biggest threat is atmospheric drag during the current solar maximum, but it is likely to make it through until the next solar maximum in the 2030s pending any one-off issues. NuSTAR is a SMEX, so there is lower redundancy. Also there is an increasing amount of space debris and alerts for close encounters with other pieces of debris or small satellites. There is currently no other funded, sensitive, hard x-ray-focusing mission in any portfolio globally. If they lose NuSTAR, that implies a loss of capability covering all of these high energy phenomena.

Dr. Grefenstette reviewed some of the specific challenges to IDEA unique to NuSTAR and working with x-ray data. The project has a strong commitment to mentoring students with a diverse range of backgrounds and is funding workshops and mentoring opportunities focused at serving students at minority-serving institutions. They provide a range of community engagement activities: booths at conferences, a special session in the DAP session at the APS meeting in April, public talks, quick start guides and tutorials, among others. Through their SURF and WAVE programs, they host undergraduate research fellowships and students from underrepresented groups to do research at Caltech over the summer. NuSTAR also participates in the dual anonymous peer review process.

Dr. Ho asked if it was possible that future missions could have extra propellant that would allow them to run longer. Dr. Grefenstette noted that NuSTAR never had propellant on board and was entirely dependent on the launch vehicle to achieve orbit. For future SMEX missions that have thrusters, certainly for something on the scale of a MIDEX, Swift, or Fermi it would have boost capability. Dr. Clampin added that on larger missions where there are thrusters, there is always tension between the mass needed for the propellant and the mass needed to complete the mission. On JWST, they got an extremely good launch and were able to minimize the amount of propellant used to go to the L2 location. Another factor under consideration is how things like scheduling can help them manage propellant use.

Dr. Hickox asked how valuable the Swift coordinated observations are and how do they see those evolving in the future. Dr. Grefenstette said that one of the things they rely on the soft x-ray observatories for is to pin down the depth obscuration for a lot of these sources. NuSTAR provides the high-energy coverage of the corona and the reflection models coming from the accretion disks around these sources, but they rely on the coverage of soft x-ray telescopes like Swift XRT, XMM, and Chandra to work together synergistically for a lot of observations. He believes that Swift's XRT observations provide a very reliable pin on the soft x-ray coverage and hopes that they will continue. Dr. Hickox asked if with a relatively fast ToO they would still get coverage in the low energies with Swift or does that take some extra coordination. Dr. Grefenstette said he would get back to the committee about how the coordination with Swift is handled in those cases.

Dr. Holley-Bockelmann noted that one of the big recommendations from the Decadal survey was that they start assessing what they can about their community. She asked if NuSTAR tracks the demographics of their team. He said the local team at Caltech is only four or five people with little turnover.

Discussion

Dr. Holley-Bockelmann told the committee they had seven minutes before the public comment period to chat about things they would like to discuss more in depth the following day.

Dr. Kiessling wanted to revisit the GOMAP talk, and Dr. Hickox wanted to look at the roadmap for GOMAP. What would the next set of concept studies look like?

Dr. Caputo wanted to talk about the inclusion plan.

Dr. Ho was interested in talking about how to make data available and easy to access for a wider community. Perhaps they could talk about it related to the open science discussion. It would be nice to bring in other community members and could also be part of IDEA inclusiveness because the data would be open to much broader communities. Dr. Hickox suggested they move things into the cloud, make all the relevant tools available so people do not have to search for them, and have them organized in ways that somebody new to the field can understand. That could provide an opportunity to open up the field and make it more accessible.

Dr. Holley-Bockelmann was struck to learn that TESS is now being used primarily for Astrophysics missions rather than what it was designed for, Exoplanets. She wondered what the learning curve would be for someone who is taking exoplanet-designed data that has been analyzed in a particular way for exoplanets, and now use it as Astrophysics data. How much infrastructure might have to be done to prepare the data to be used in another way?

Public Comment Period

The meeting provided an opportunity for public comment.

Dr. Hickox read the top-rated comment. How do the spin and mass of planets affect the masses and orbits of moons? Dr. Holly-Bockelmann said that was more of a Planetary Division question than an Astrophysics Division question. Dr. Hickox added that using things like the Rossiter-McLaughlin effect could measure the rotation and spin of stars and how that affects the orbits of their planets. If exomoons are eventually detected, the Astrophysics Division would look into this question.

The next questions were about the budget. What are the expected budget constraints for fiscal year 24 and the consequences? Is there any sense of how the updated cost increases for Mars sample return (MSR) might impact the APD budget and implementation of ASTRO 2020? Dr. Clampin said he could not speak about the expected budget since it is still under discussion. MSR is currently in formulation, which means

it is in the process of completing its preliminary design, and NASA is evaluating a wide range of funding scenarios. In October, they will have a better idea of what the financial outlook is.

The next question asked about the status of studies by SpaceX and others to reboost the orbit of Hubble. Dr. Clampin said they conducted a study with SpaceX and issued a Request for Information (RFI) to look at other options. They are evaluating the results of the SpaceX study and are looking at how they would do it if they proceed with SpaceX or one of the other proposals that were submitted as part of the response to the RFIs. It is a very complex operation and they want to make sure they understand all the constraints before they decide how to proceed.

Dr. Hickox read some questions related to HWO. Is HWO a full NASA effort engaging all the NASA centers? Are START and TAG the only HWO study teams? Is there anything else in terms of input from the community that they have not heard about yet? Dr. Clampin said the HWO will engage all of the NASA centers. They are just at the beginning of this program and moving forward relatively slowly within the current budget constraints. The current activities are the START and TAG, where they will rely on centers to provide some very low levels of analysis to help inform the work done by the START group.

The next question asked how the technical requirements for HWO follow from the scientific requirements and if there is public documentation. Dr. Hickox referred people to their previous talk on GOMAP, which covered that issue.

The final HWO question asked when the START acceptances will be announced. Dr. Clampin said it would be addressed the following morning when the committee took additional questions.

Dr. Hickox referred the final questions to Dr. Connaughton. Why are there page charges for the TDAMM workshop? And could this be covered by NASA directly rather than asking for a waiver by the publisher? Dr. Connaughton said that issue was being worked on. Dr. Holley-Bockelmann noted that people can apply for the fee waiver through the portal.

Wrap up for Day 1

Dr. Holley-Bockelmann thanked everyone for a productive day and said she appreciated the attention the presenters gave to tailoring their presentations to the topics the committee wanted to know.

The meeting was adjourned for the day at 5:00 p.m.

Wednesday, June 28

Opening Remarks
Dr. Hasan welcomed the group to the second day of the meeting at 9:01 a.m., read the introductory administrative announcements, and turned the meeting over to Dr. Holley-Bockelmann.

Dr. Holley-Bockelmann welcomed the group, noted that they designed the agenda so there would be plenty of time for discussion, then introduced Dr. Roopesh Ojha.

Year of Open Science Update
Dr. Ojha opened by saying it is a fantastic time to be talking about *a* year of open science, the first of many. As they enter a bold new future, it is a great time to solicit advice from the APAC.

He began his presentation with a definition: Open science is the principle and practice of making research, products and processes available to all, while respecting diverse cultures, maintaining security and privacy, and fostering collaborations, reproducibility and equity. He noted there is a lot in that definition, but it is an attempt to balance many complexities such as openness and the risks associated with security and privacy.

There are four basic principles to Open science:
• Open the entirety of the scientific process from start to finish. You do not want to pull people in when you have already set things up.
• Broaden community involvement in the scientific process. The issue is how to do it most effectively. NASA is working with federal dollars and they should benefit everyone ideally, but at least as many people as they can. Plus, the more varied experiences and points of view they bring to the table, the more likely they are to get better science. So it is the right thing to do but it is also the most efficient way to do it.
• Increase accessibility of data, software and publications.
• Facilitate inclusion, transparency and reproducibility.

For a year of open science, NASA's community engagement includes a program called Transform to Open Science (Tops), a $40M, 5-year mission to accelerate the adoption of open science. He reviewed the strategic goals and priorities of the program, including the curriculum, events, and opportunities it is designed to provide.

Dr. Ojha noted that large sections of their community are no strangers to open science. A lot of astronomers are completely comfortable with developing software openly and sharing their ideas. But “large numbers” does not mean everybody. The idea is to introduce those beginning their open science journey to ideas about how to best do it, and then provide participants at all levels with recommendations on the best practices from subject matter experts.

The Benefits of Open Science will be presented as a scientific workflow with five modules. At this point, the first module is available only in person. Because they believe in open science and open practices, eventually they will put everything online, but much of this works best if people actually attend in person and in a group.

SMD’s updated and scientific information policy, SPD-41a, went into effect in December 2022. The update is forward-looking, was developed with community input, and has broad community support. The policy updates does not require people to reveal preliminary results.

There are two documents Dr. Ojha suggested that everyone in Astrophysics review. The Open Source Science Guidance, a narrative on how to comply with SPD-41a, provides options and examples and is relevant across SMD divisions. The Astrophysics Science Information Management Policy clarifies details of the implementation of SPD-41a to the scientific information that is produced by the Astrophysics Division-funded activities and provides guidance through the complete information lifecycle from measurements and information creation to persistent accessible curation and sustainment.

Dr. Ojha spoke about the four principles he was directed to be guided by as he did this work. The first was do not do any harm. The Astrophysics data world is very complex but it has been functioning for decades. That should not be compromised. The second principle is to incentivize. When questions arise about compliance, they prefer to incentivize people to do something. The third principal is they would like to make it a minimal effort and part of the normal workflow. The final principal is value-added. It is a non-zero effort, which means there are non-zero resources required, so it better be worth it. If elements of it do not appear to be worth the effort, they will seek advice from the APAC.

Dr. Ojha reviewed the approach and the concept of scientifically useful data. He noted that they do not have jurisdiction over people in other countries, but they unofficially know that several international partners are delighted with them taking lead on this because it helps them convince their leadership to move in the same direction. But if an international partner, despite their best efforts, insists on a variation, they would hope to make this a rare occurrence with justification unique to the mission. It should not be standard that people can waive these policies.

Before reviewing the waiver process, he noted that they recognize there is a complex range of reasons why people might need more time, and they certainly do not want to go out and hurt the very people that they are trying to help. They have already had this waiver process at work in at least a couple of GO/GI programs, and it has been working decently.

Dr. Ojha reviewed the three components of the Astrophysics Science Platform project and the data landscape predicted for 2030. The community users of the platform include scientists needing server-side analysis for large amounts of data, those needing computational facilities for big data analytics like machine learning, collaborators at different institutions wishing to share a computational environment, and scientists who cannot easily build the software they want to use. Achieving these goals is necessary for diversity and inclusion goals to be met. The fourth point, scientists who cannot easily build the software they want to use, is very important to include to improve accessibility of people who are not at R1institutions. So they actually help everybody. Even if someone is at an R1 institution, if that person does not have to struggle with installing some complicated software and do the troubleshooting, it is a benefit. Improving accessibility for people you think need the improvement actually ends up helping everybody.

Dr. Ojha quickly reviewed the SMD RFI Scientific Data & Computing Architecture to Support Open Science and closed by noting that this is a very exciting period in this whole field. They have volume of data, the complexity of data, and open science, which seems like it came along at just the right time. It will help them to use these new tools and broaden the access to the community with the ultimate result that they get the maximum bang for the federal dollar.

Discussion

Dr. Tremblay shared two ideas with the committee that he had learned about. The first is to make accepted NASA observing proposals a citable DOI-linked object that would act like a container. The idea is as they head toward a new future of more open science, and that means a lack of proprietary time, the accepted proposal is a piece of citable IP that the successful proposer can be credited for. For example, Dr. Hickox has an accepted JWST proposal and there is no proprietary time. Someone can scoop him and

take the data from the archive and they are within their rights because it is open data and he does not have a publication from it yet. But the person cites the proposal name and provides the ADS citation and that proposal is a container for any future IP that comes from that project, be it code or publications. The actual software infrastructure at the NASA ADS-level Space Telescope, MAST archive, Chandra archive all have API hooks so the existing infrastructure is there and it is not hard to imagine it happening in the near future.

Dr. Pascucci asked about are the milestones of the TOPS project over five years and how they would assess quantitative success of the project. Dr. Ojha said the goal is to train 20,000 scientists in open science practices, double the participation from minority-serving institutions, and enable five major scientific discoveries. If they do reach out to more than 20,000 scientists who have taken the training and are well-versed in open science practices and they double the participation from minority serving institutions, it will give a sense of how successful the whole program has been. As for the major scientific advances, hopefully it will be clear what a major advance is.

Dr. Ho asked how many GPU or CPU hours they are preparing to provide to users or are they paying for AWS credit themselves. Dr. Ojha replied that currently people can apply for CPU time, and from October they can also apply for GPU time, at their high-end computing center. They will have a senior review where they will solicit additional and expert input, so they have a sense of how much they should be planning for.

Dr. Holley-Bockelmann said she understood that you can apply for High End Computing(HEC) time if you get a proposal accepted. So how does it work with the open science idea that you first have to have a barrier of getting a proposal accepted before you can work with data in a practical sense? Dr. Ojha said it would be analogous to getting a grant. You would want a peer review to evaluate a proposal before you give resources. Dr. Holley-Bockelmann noted the AGC proposals are evaluated themselves, and you cannot apply unless you have a scientific grant accepted. That is an inconsistent with the ethos of the open science concept, especially if you want to reach out to under-resourced institutions who may not have gotten through the barrier of getting an advanced proposal accepted and then an HEC proposal accepted afterwards. Dr. Ojha said currently someone would apply via one of the ROSES calls to deal with the problem and then state in the application that to solve the problem they need the GPUs. What is the alternative that you would like to see? Dr. Holley-Bockelmann answered that if data are open in public, then I should be able to access the data at some under-resourced institution and work on it. What are the barriers that people have to pass to be able to use this? If you have to get a grant funded before you can use AGC resources, that is a pretty big barrier with approximately 25 percent acceptance rates and most going to R1 institutions. Dr. Ojha said it is something he is fairly sure they are going to incorporate into the platform, but he would need to check.

Dr. Ho noted that one GPU hour costs about a dollar, so it is not inexpensive if you want to run 10,000 hours. So how would you do that? She believes it would be impossible to consider giving a certain amount of credit for each user without all the applications. Dr. Holley-Bockelmann suggested having an automatic playground amount of hours for anyone, even for training. Dr. Ojha said that was a great suggestion. Dr. Hickox added that he thought the plans for Roman data analysis include something where everybody can automatically get some time on the cloud if they apply.

Dr. Caputo asked Dr. Ojha what scientifically useful data meant? Dr. Ojha said it was any material that you as a scientist would need in order to access, interpret, evaluate, validate, or reproduce the results of a scientific project. So, it is R&R — reproducibility and reuse. They believe that the PI is the closest to the project, and at least in the first instance, they expect the PI, as a user in general, to make a determination of what is scientifically useful. They also believe that the vast majority of those who work together are working in good faith.

Dr. Caputo heard concern in the community that because of the small amounts of funding for certain projects, they are not going to be able to comply to SPD 41, and that even if they do comply, it will not actually be scientifically useful. She asked if they need to make it such that anybody in the community can reanalyze the data and verify the results that you may already have gotten? Part of the concern is that the extra layer of analysis and effort that is required would then come out of the funding pot from the proposal. Dr. Ojha reiterated that this is forward looking. So, if you are working on something that has been around, they would ask you to do your best to comply with what you can. Going forward, they ask you to include in your data management plan, your open science plan, and your estimated costs to comply with 41a. You should have the resources to comply, so going forward you need to ask for the resources that you reasonably need.

Dr. Hickox said he appreciated the fact that they are thinking about doing something for tenure and promotion and giving credit for observations that one proposed for. He asked if they were also thinking about ways to make sure that people take credit for code they have written and is used. He believes that people are doing a pretty good job of citing the relevant papers when they use somebody's code base, but if they do this right, it is going to get complicated, and there will be multiple layers with bits of code that you did not even know were in the cloud computing resources that you use. Dr. Ojha said it was one of the main things they talked about in the last year or so, but it is inherently complex. They do not control the world, so they can only make good suggestions. He said he would reach out to Dr. Hickox later.

Dr. Hickox asked if there is any scope for including something in the cooperative agreements with international partners that says when they are working with the data, they are going to have to abide by this. Dr. Ojha said 41a makes clear that their starting position in any conversation with any partner, domestic or international, is that they want data to be open. If an international partner chooses to push back on it, they will have to have a compelling justification. Dr. Clampin confirmed that is the case. In missions that they are starting on now, they are having discussions about the policy of open data and how that would apply to new future missions. They have already had a number of financial discussions with partners about how that is going to work. He also noted there are useful open science resources hosted in other countries, like CDS (Strasbourg Astronomical Data Center) in France. Rather than reinvent the wheel, those resources could be critical pieces of this open science infrastructure.

Dr. Holley-Bockelmann had just checked and found there are proposals on ADS and code that is officially on ADS. What else was it that people wanted? Dr. Ojha said they are pretty good at crediting people's scientific research, but they are not very good at crediting people who develop software. How do you do that in a reasonable and fair way? That is one of the key things they are working on. Dr. Holley-Bockelmann said her understanding is that there will be some sort of technology to inform people about codes they find on ADS.

Dr. Kiessling asked that when they are talking about making data open from our international partnerships, it will be made public after certain proprietary periods. Is that consistent with what they are trying to achieve or are they trying to convince international partners that they should make their data open worldwide? Dr. Clampin said they do not want to dump raw, uncalibrated, unassessed, or unvalidated data. They will be making data free and open in the context that the data needs to be validated or processed to the extent required before it is available. Dr. Kiessling asked if it was consistent that data will be proprietary for about a year-and-a-half for Euclid and then made public. Will there be future conversations to try to convince international partners to reduce or eliminate proprietary periods? Dr. Clampin replied that Euclid is a mission that was created before this policy. Going forward, they are trying to avoid proprietary periods and they will take each mission on a case-by-case basis.

Dr. Ho stated that one of the major policy updates says mission data are released as soon as possible and unrestricted mission software is developed openly. Does that also apply to the software developed by researchers because there is software that could be dual use in principle and that is currently not reflected at the policy level? Dr. Ojha said the answer is yes, but there are important exceptions to avoid such problems e.g. if the software is proprietary restricted by International Traffic in Arms Regulations (ITAR).

Dr. Holley-Bockelmann appreciated the idea of piloting with five universities and in the size. Have they released a call for that and what is the process to determine which institutions they are going to partner with? Dr. Ojha said the initiative is at the SMD level, and he is not exactly sure how they were selected, but he will find out.

Dr. Gaskin asked a question about proposals for developing tech. She said, "You do not want to post that proposal anywhere because it gives a competitive advantage and you always follow on because your technology is never done. So if you are suborbital and you put your data out there, along with the tools to reduce that data, and you might not be able to put your proposal out there or anything that actually claims that kind of first all encapsulating thing." Dr. Tremblay responded that people were a little upset over a potential JWST ERS proposal releasing and someone publishing the data, and the original proposing team felt like they did not get credit. A suggestion was, why not just make the JWST proposal a citable paper object? That object is not just a paper, it is a container that contains DOIs to both the citable DOI Zenodo GitHub repository, any future papers that that author or any other authors might wish to publish on that data. Citations are part of the currency of the realm to align incentives, get people more citations, make a proposal a citable object. Dr. Gaskin said it sounds like a great start to a good idea. Going back to limited resources for suborbital or pioneers, where there is not a lot of resources to do this very well and analyze data very quickly, that is an issue. Finding some solution that would help incentivize or remedy that would be very helpful. Dr. Ojha said one idea is to just cite the abstract, which is already done by many observatories. An idea is to treat software completely different was proposed by a number of professional programmers who said, just pay us. They want full-time jobs with good salaries and do not care about citation.

Dr. Clampin pointed out that the intent of the JWST ERS proposal was that they had zero proprietary period. They were there for the whole community to take an early look at JWST data, providing the whole community, including all those people that did not get signed for one time, the opportunity to look at the data and work with it.

Dr. Ho asked how to define something dual use or ITAR. For example, if you are building the equivalent GPT-3, is that the kind of software that you need to be released because you are using that for your science? Dr. Ojha said he cannot say anything specific about it. They are discussing that throughout the government.

Dr. Clampin said they would appreciate advice from the APAC about incorporating AI machine learning into APD programs. They are getting guidance from SMD and other federal agencies and stakeholders to start thinking about it. Are there ways that they can leverage resources they have to do a better job or provide people with more tools? How do they get people to innovate in this area? Should they be encouraging them to work with industry on R&A proposals?

Dr. Caputo asked if there were any statistics about people who are not part of the R&A project wanting to analyze the data from those projects. Dr. Ojha replied that currently they think that data belongs to the team that generated it. But it is useful to think in terms of primary, secondary, tertiary, and future use of the data. Dr. Caputo talked about the need to maintain data and the resources that are allocated as part of a grant and asked him to consider trying to understand the community. It would be interesting to know if

APRA proposers would like to use data from other selected APRA programs or SAT programs. Dr. Ojha said they will definitely gather numbers and statistics on reuse and make them widely available. The most important message is they do not expect anyone to do anything that does not seem reasonable. If you have doubts, talk to your program officer. Dr. Caputo said that people might not understand what NASA means by the inclusion plan because it is not prescriptive. In a way, that is good, but they also do not know what the expectation is. Dr. Ojha noted that there is training available on the inclusion plans.

Dr. Holley-Bockelmann pointed out that Dr. Ojha had mentioned it is always possible for GI/GO programs to request proprietary time. She asked if he had data about how many people have taken that up, both applicants and those who have been successfully selected. He said it is early days, but there is one program where they have gone through three cycles of the GI/GO program. Roughly 30 percent of the proposals requested proprietary time and between 80 and 90 percent of them were granted.

COPAG/PhysPAG/ExoPAG Discussion

PhysPAG

Dr. Finke began his presentation with an overview of PhysPAG and said each of their seven SIGs includes both science and technology. Their SIGs worked differently than those in the other PAGs, and each SIG is chaired by someone who is on the PhysPAG Executive Committee (EC).

He reviewed their recent activities (extra details were provided in additional slides). They have had a fairly large increase in their subscription mailing list subscribers as a result of bringing a sign-up sheet to the APS meeting, which increases their visibility to the community.

Their newest SIG, which was recommended by the APAC last year, Time Domain and Multi-Messenger, has been approved by NASA. It is cross-PAG with the COPAG and ExoPAG. The idea is to have this single lead out of the PhysPAG, so they will have two chairs from PhysPAG and one each from COPAG and ExoPAG. The Terms of Reference is in the Google drive and accessible to the APAC.

They had a session at the HEAD meeting that had a lively community discussion focused on the ASTRO 2020 recommendations related to TDAMM and NASA's response to it. There is a lot of frustration in the community about NASA's response to the recommendations and a lot of concern that when Swift and Fermi fail, there is no real replacement on the horizon.

Dr. Finke has some concerns related to science gaps and their process to collect input and revise their list. One concern is that they will get a huge response because their science is so large and it will be unmanageable, making it difficult for the EC to revise the list. Another concern is that they might get a flood of responses from certain science areas and few from others. So there will be gaps within the science gaps. Perhaps the EC could come in and help fill in those gaps.

In July, the Gamma-ray Transit Network SAG report will be the first post-Decadal SAG report to be delivered to NASA headquarters. As a reminder, it is related to the Gamma-ray Interplanetary Network (IPN), a series of gamma-ray detectors in Earth orbit and throughout the solar system whose information is combined to triangulate the locations of gamma-ray transients.

Dr. Finke introduced a Gamma-ray Roadmap SAG that they plan to propose at the October APAC meeting and reviewed the questions it would address and its proposed timeline. This SAG will be more focused on motivating science rather than science gaps. They would like to have the SAG approved after the October meeting and have it wrap up by the beginning of 2025. They would like the APAC to provide feedback now so that the new SAG can be approved without any issues after the next meeting.

Dr. Pascucci asked about the process for getting chairs for the TDAMM cross-PAG SIG approved. Dr. Clampin said the recommendations will come to him and he will sign off on them.

In response to Dr. Finke's concerns about science gaps, Dr. Gaskin suggested they do it in stages. Dr. Holley-Bockelmann wondered if they had had any discussions with the ExoPAG community who had done that. Dr. Finke said they are certainly open to learning from ExoPAG's experiences. ExoPAG had a lot of the same concerns when they were putting together their science gaps, so Dr. Hickox suggested PhysPAG talk with Gary Blackwood from JPL.

COPAG

Dr. Nikzad noted a lot has happened since March then focused on the SIGs and their activities.

COPAG has been exploring new SIGs, the Student SIG and the Diffuse Gas in Cosmic Ecosystems (DGCE), which is off to a good start. The new chairs, Drs. Erika Hamden and Dr. Hsiao-Wen Chen, are now in place and they have formed their leadership team. COPAG does not have every SIG chair or lead on their EC, but the SIGs and STIGs (Science and Technology Interest Groups) all are invited to attend the EC meetings and COPAG-EC has great connections with each lead.

The Student SIG is also off to a good start, but there is work to do to have their Terms of Reference and leadership established. Dr. Nikzad showed some photos from the Black Space Week that Dr. Ron Gamble put together to allow for professional development from a diverse group and remove barriers for engagement with the broader NASA community and the Leadership Council.

COPAG-EC held their strategic planning retreat which will be discussed later in the presentation. When they planned their strategic retreat, they recognized they had their EC members and SIG and STIG leads in Pasadena, close to JPL. So, they arranged to have a mini workshop with the members of the COR (Cosmic Origin) community and Exoplanet community. They see the need to come together over common goals as they examine the capabilities that they all would like to have in HWO. In addition to the mini workshop, on one afternoon while the EC leadership met with their strategic planning facilitator the rest of the team worked on mapping the Decadal survey question to missions.

Dr. Nikzad then briefly discussed the highlights from the IRSTIG workshop in July. A Leadership Council has been established for which the IRSTIG is soliciting membership.

COPAG also stood up a UV Science and Technology Working Group to gather everything that has been done relevant to the topic and publish it in peer review so there is no anecdotal reporting. The group's chair has recruited members, and their first meeting was on June 28.

COPAG also had its retreat on May 11-12 at the Keck Center thinktank and the KISS center. Working with a facilitator, by the end of the second day, they had produced their mission statement, vision statement, and a broad outline of their goals and objectives. Since then, the COPAG EC leadership (COPAG EC Chair and Vice Chair, COR Chief Scientist and Deputy Chief Scientist and COR Program Scientist) has met a couple of times with the facilitator to flesh out the goals and write the plan based on that work. After the plan is finalized, they will have actionable objectives that they will assign EC members as champions for that objective to work with the community to get those objectives met. COPAG looks forward to working with the program office NASA HQ, the COR community, and the other PAGs to implement the objectives.

Dr. Holley-Bockelmann asked Dr. Nikzad to share some of the priorities they identified in their strategic planning. Dr. Nikzad noted that their goals include having a great connection and engagement with the COR community, making sure they have a vibrant and engaged community, taking care of the workforce

pipeline concerns, having good communication with the program office and headquarters, maintaining a structure that is transparent (who does what, etc.), identifying the gaps in science *and* technology, and helping with the technology roadmap.

ExoPAG

Dr. Pascucci began her update on ExoPAG by reviewing the Terms of Reference, introducing the six new members who have joined the group since the March APAC meeting, and showing a slide with the names and institutions of the 13 ExoPAG EC members.

After reviewing their ongoing and recent activities, she updated the group on the ExoExplorers Program, which is now in its third year of the Exoplanet Explorer Science series. Supported and sponsored by the ExoPAG Executive Committee, as well as NASA's Exoplanet Exploration Program, the Science Series aims to aid the professional development of early career scientists.
ExoExplorers participated in two new major activities: a discussion panel on balancing science, career advancement, and IDEA efforts and a multiday workshop on software development and software publication skills. This program received the 2022 NASA Honors Award for the development and implementation of the program itself.

Typically, ExoPAG meetings are held in connection with the AAS meetings, so they should have had one meeting in the summer. However, to strengthen their collaboration with the planetary science community, they moved the ExoPAG28 meeting to just before the October Division of Planetary Science (DPS) meeting in Texas. They are actively working on the agenda and getting input from SIG3, which is exoplanet and solar system synergies. At a meeting in May they also discussed the APEX/OSIRIS finding.

SIG2 had a change of leadership. The new leaders are Rachel Fernandes and Samson Johnson, two early career scientists. Johnson is also an EC member and the EC assisted in the change of leadership. The two new leads are asking for new coordinators and members, who will be solicited through the ExoPAG announcement. The new leadership will also present their updated goals at an upcoming meeting.

The main thing Dr. Pascucci wanted to present to the APAC and get feedback on is a new proposed SAG by the ExoPAG community, which they call the Starshade Science SAG. This SAG would be led by Dr. Sara Seager and Dr. Stuart Shaklan. The main motivation for the SAG is to identify the unique and critical science that the Starshade can enable in connection with and complementary to the coronagraph. The Terms of Reference for the new SAG were on Google drive and accessible to the APAC.

Dr. Pascucci showed a slide summarizing some of the key points from the Terms of Reference:
the UV capabilities of a Starshade, the advantage of a simultaneous broadband spectral coverage to characterize exoEarth and other exoplanets, and the relevance of high throughput. In addition to identifying the unique and complementary capabilities of a Starshade to the coronagraph, they want to consolidate what is known about exoEarth and exoplanets and review the current gaps in those science areas.

Dr. Pascucci showed a slide that outlined the goals of the proposed SAG to assess the scientific value for broadband instantaneous spectral coverage to characterize exoEarth and other exoplanets and the capability of reaching the UV to identify the ozone as a biosignature. She added that the SAG aims to have end-to-end Starshade simulations to estimate the yield of exoplanet detection and characterization of a Starshade combined with visible-only coronagraph. She requested the APAC approve the Terms of Reference and provide any feedback on the proposed SAG.

For next few minutes the group discussed a range of issues with the Terms of Reference as written. Dr. Kiessling noted that Dr. Pascucci had eight goals on her slide but the Terms of Reference had only six. Dr. Pascucci said it is possible that one goal was split into two. Dr. Hickox said some of the points are specific to the Starshade, but others appear to be really broad. Goal number one is enormous and some goals could use a bit more focus. Also, it was not obvious how goals seven and eight are directly relevant to Starshade. Dr. Pascucci thought goal one is quite complementary, and they could get some input from SIG2, which is the exoplanet demographics. She asked the APAV if they would like to see a revised Terms of Reference. Dr. Holley-Bockelmann said they would because goal one had to be changed to make it more correct.

Dr. Pascucci said the group wanted to start working on this SAG and asked if they could provide a revised Terms of Reference in a few weeks before the next APAC meeting. Dr. Caputo said if they are not comfortable with the Terms of Reference, they should wait approve it. Dr. Pascucci asked what the role of the APAC is because her understanding was that these are community efforts, so they do not need a formal approval. She could tell them that the APAC wanted an updated version of the Terms of Reference and they could start working on goals that are more specific to the Starshade science. Dr. Holley-Bockelmann said that work could be done as individuals, but not as members of a SIG or SAG.

Dr. Caputo added that if it was going to be considered as part of the HWO technology, then it should be part of the START and TAG. If not, she did not understand the purpose. Dr. Pascucci said her understanding is that START could initiate some SIGs and SAGs and one of them may be related to the Starshade science, but this Starshade Science SAG request comes from the community.

Dr. Tremblay thought the Terms of Reference read fine as is. If the community wants to talk about the great science that could be enabled by a future Starshade, that is fine, but it will be important that the group interfaces and works coherently and in conjunction with the START and the TAG and does not provide any interference. But Dr. Caputo said there should be more clarification as to how these play with each other and also a future Starshade. This is specifically for HWO, and she would like to understand how they fit with the TAG and the START.

Ms. Crooke described for the group what the START and the TAG are and are not. The START and the TAG are literally taking the Astro 2020 report and teasing it apart and peeling back the layering. The job of the START is to understand each of the qualitative science objectives and help turn them into quantitative measures so that they understand what the observatory characteristics at the observatory or the instrument level are and what they need to enable that science, as well as understand their breakpoints? NASA and the future pre-Phase A project office will execute trade decisions, but the TAG and the START will work to understand and document the trade space. Dr. Pascucci asked Ms. Crooke if she thought the work the Starshade Science SAG is proposing would be valuable and informative. Ms. Crooke said she would need to understand the scope of it.

Discussion
All discussion was included in the prior section.

Public Comment Period
Dr. Hickox read the questions voted on by the public. “Can Mark please comment on the utility to headquarters of Science Gaps lists for fields as broad as PhysCOS and core. Mindful that the except lists were developed over a roughly ten-year period, will such lists be useful from a strategic planning point of view, and will there be sufficient resources made available to maintain these lists as a living biannual document?” Dr. Clampin said that in this context, he worries about the nomenclature and thinks science priorities may be a better way of stating it. But it is useful input. At least every two years, depending on

the program office, they collect priorities anyway, which do inform SAT investments, for example. So they are useful.

Dr. Holley-Bockelmann read a question from the chat: "We understand that University of Hawaii is trying to remove its affiliation from Mauna Kea observatory facilities. If it does, then how would exoplanet research move forward? It seems the Hawaii governor is interested in refocusing on the InfraRed Telescope Facility (IRTF) and Keck." Dr. Clampin said he understands that the management of Mauna Kea will transition to this new management committee set up by the State of Hawaii in several years. They are planning and will interact with that new committee as they continue to operate their contribution to the Keck and the IRTF programs.

Online Marufa Bhuiyan asked, "Yesterday there was a lot of conversation about startups, business funding, various projects. I own a business here and we are working for three years. We met the governor and asked him for funding, so how do we get money? Who pays the CEO? I should get paid from somewhere." Dr. Holley-Bockelmann interpreted the question as, is there NASA funding for industry partnerships in general? Dr. Clampin said yes, there is the (Small Business Innovation Research (SBIR) program, and they work with small businesses through that program to do technology investments, for example. Many other NASA programs have requirements for a certain contribution of small businesses. So, there are options.

Dr. Holley-Bockelmann closed the comment period and the group broke for lunch.

Lunch
During lunch Dr. Philip Kaaret gave a talk on the first science results from IXPE.

Discussion
Dr. Holley-Bockelmann began the discussion by noting there was a request to discuss Starshade.

Dr. Clampin said they welcome all input for consideration and they are not trying to stifle discussion or innovation. He also pointed out that the START group is not setting requirements, they are informing trades. At some point a project will be set up to do pre-formulation through to science operations, and they will take the information and do the initial trades for the architecture. Astrophysics is still invested in the Starshade in a relatively small way, with work underway from the previous work done by the Exoplanet Program Office. Lessons have been learned from JWST and the work done over the last 15 to 20 years on the deployment of the sunshade. As the Starshade does its last mechanical TRL assessment, they plan to have people involved in those deployments review that TRL assessment.

The AASI stated what the approach is going to be to the HWO. Dr. Clampin worked closely with Dr. Zurbuchen and they consulted with JPL and Goddard Center directors. He has had numerous discussions with the Decadal chairs over the last year and briefed their stakeholders on the approach and how they intend to address this mission. Also, there have been discussions with industry about capabilities. The approach was the fruit of quite a bit of work and they are not planning to change the big picture approach. To follow the Decadal recommendation, before the end of the decade they need to have gotten to TRL 5 and conducted an independent review of the approach forward into pre-formulation. This approach provides the maximum ability to leverage the investments already made and the maximum science flexibility going into the pre-formulation phase. There is risk with any approach and they have tried to minimize that by leveraging the investments in JWST and in technology in APD over the last decade. That way they maximize their chance of success and get to a successful independent review before preformulation starts before the end of the decade.

Dr. Hickox asked to clarify that in the current long-term plan, the architecture is not being considered for HWO for the Starshade SAG to look at what the capabilities of a Starshade might be. Dr. Clampin responded that they are not planning to make any further investments at this time, However, at the pre-formulation phase they will take input under advisement as they look at the architecture for the telescope.

Dr. Kiessling pointed out that they received an updated set of Terms of Reference from the Starshade SAG and asked if they could move for an approval. Dr. Hickox thought the revised version appropriately addressed the issue he noted. Dr. Pascucci moved for approval, Dr. Hickox seconded it, and the motion was carried. No one opposed.

Dr. Kiessling pointed out that Dr. Clampin indicated they want to be at TRL 5 before the end of the decade, by the beginning of pre-Phase A. Getting to TRL 5 by FY28 could be difficult budgetwise. How is NASA planning to get to TRL 5 by around FY28 with the current budget? Dr. Clampin replied that in October they will be better able to talk about the funding. Ms. Crooke clarified that the goal is to get to TRL 5 by Phase A not pre-Phase A. Dr. Caputo said that without knowing what technologies are being proposed, it is hard to say that something is going to be at TRL 5 at a specific point. She would like to see a schedule of the process by which the science requirements will be laid out, the technologies that can potentially achieve those requirements, the current TRL, then a plan to get to TRL 5 by a specific date. Dr. Champlin said they are working on roadmaps that lay out the key requirements for the TRL 5 goals and hopes that at least one of them will be ready to be briefed in October.

Dr. Tremblay asked what the role of industry will be the TAG. He noted that Thomas [??] was on record at the AAS a year ago as saying that no less than 75 percent of GOMAP will go to industry. Ms. Crooke responded that historically 85 percent of agency funding for missions goes outside of NASA, so they will continue to do that. Industry is allowed to be on the START, but they are not allowed to be on the TAG. The TAG is made up of NASA personnel only, and their primary job is to identify the architecture, high-level design, and the trade analyses they need to get done that they can compete via ROSES. She is putting together the ROSES package for the eventual release. The TAG will help identify the things they need to release to the community. It can be industry/academic teams or just industry. The TAG will be a relatively small team made up of NASA personnel for the sake of putting analyses out that they can compete openly to the community. That is the plan to deconflict the process when involving industry colleagues. Dr. Clampin added that for the segmented mirror program they are already talking with industry partners and getting them engaged in thinking about it. The Exoplanet Program Office has talked to potential sources to get them interested in the next generation of deformable mirrors.

Dr. Hickox asked if there were specific lessons learned, particularly from JWST or Roman, about what they should be doing at this point with industry partners to make sure they stay on schedule and budget. Dr. Clampin replied that once a schedule and budget are established, they will follow the recommendations and the outcome of the NASA Large Mission Study. For that study, they looked closely at missions across all four science divisions that build relatively large spacecraft, especially Science and Planetary. They came to conclusions on things like formulation and governance and laid out a roadmap going forward for large missions. For example, they said to set up an SRB when the Project Office is created so they are involved and there is continuity across the mission.

Dr. Kiessling returned to the “Advancing the HWO Concept” slide from Dr. Domagal-Goldman’s presentation. She noted that when the START and the TAG begin their efforts, they are going to be expanding the trades before narrowing it. She asked what the bid is going to look like, what the timeline will be, and who will be involved in expanding the trades and then narrowing them down. Ms. Crooke pointed to the space on the slide where the words “science requirements,” “mission architecture,” “technology,” and “mission design” were and said that is where the TAG and the START reside. They are setting up the information analyses and assessments of the trade space before the pre-Phase A project gets

set up to make quicker, informed decisions. She said they plan to take the documentation and final reports on the analyses from the TAG, the START and the industry teams, and have it independently reviewed for accuracy and completeness.

When a pre-Phase A project is established, those reports will be handed to NASA to help expedite informed decision-making. But before that, when they have an idea when the pre-Phase A will get set up, if the trades are not completed they will ask the teams to document where they are, what they have and have not completed, and what are their assessments are thus far.

Dr. Holly-Bockelmann pointed out that Ms. Crooke said the people who will be chosen for the START team have to commit to taking on a mentorship of another person, and she added, there would be a lot of benefits if that were the policy for the TAG, as well. Ms. Crooke said it would be a policy for the TAG. It is a great opportunity to bring on more subject matter experts and train them. It will initially be for HWO, it will eventually be true for the other flagships. Dr. Holly-Bockelmann asked if the mentees were going to be paid and how they would be selected. Ms. Crooke said for the START they are going to put out a separate call directed at R2s and small colleges, and they would like to do the same for the TAG. After they know who is on the START and what institutions they represent, they will try to target other institutions to get as many people involved as possible. Dr. Holly-Bockelmann added that deciding who sits at the table is incredibly important at the very beginning, so it is important to think carefully about that.

Dr. Domagal-Goldman added that they want to have a discussion with the cochairs and the START on the specific implementation. What the APAC is hearing is their plan, but they want the plan to be cocreated with a team they pull together from the START. This is all to make sure that the teams have the expertise to successfully get to where they need to be in a fairly short amount of time against a difficult technical challenge, while also ensuring that they continue to train new people. They have also talked about ensuring that new people are continually included in these endeavors. In a world where the STARTs and TAGs are convened for more than a year or two, they look to bring new people on and have some rollover.

Dr. Tremblay wanted to clarify that within a couple of weeks they will name the START cochairs and then, in concert with the cochairs and an APD committee, they will select between 15 and 20 START members. Ms. Crooke said that she will not be on the selection committee, but it will include a subset of APD, not APD as a whole.

Dr. Kiessling asked Dr. Champlin about following the Decadal survey guidelines once there is a schedule and a budget. Which parts of those guidelines does he intend to follow? Is it the schedule, the budget or both? If it is both, the Decadal survey mentioned an early 2040 or 2042 launch and a budget of $11 billion. Assuming they start around FY28, that means that the annual budget for HWO will be larger than the peak spend of Webb every single year. Dr. Champlin replied that they have to follow the particular guideline as the budget commits, and they will need a commitment from their stakeholders. Conversations with stakeholders have begun and they have been informed that to build to a schedule they all have to commit to the funding profile expectation or there will be delays. They will have those discussions toward the end of the decade.

Dr. Holly-Bockelmann asked Dr. Domagal-Goldman if the selection committee had been chosen. He said they pulled together a selection committee of APD personnel. They wanted coverage of physics of the cosmos, cosmic origins, and exoplanets, and to have demographic diversity on the selection team. The plan is to pick the cochairs and then add the cochairs to the selection team for the full START.

Dr. Tremblay asked Dr. Clampin to share NASA's top-level thinking on the mid-Decadal and when they might want to charter it with NSF colleagues. Dr. Clampin said toward the end of the year or sometime year, they might start to have those discussions with the Academy.

Dr. Gaskin asked for clarification on whether Dr. Clampin would like their input on AI in software or across the board. She said a colleague from Goddard came to her with an implementation using AI with mechanical design tools to design wider, stronger structures for payloads. Because he is in the mechanical engineering group, he did not know how to show the astrophysics community how to best use the skills and capabilities they have been developing. It could be useful in a world of CubeSats and small SATs, but nobody seems to know about it. Dr. Clampin said he was interested in the APAC's advice on incorporating AI/ML into the work done in astrophysics and how they can use these new techniques to further the scientific objectives. There is a mandate to look at this as an agency, so how can he work with R&A scientists and program executives to incorporate it into R&A programs or encourage people to work with industry to do it? The agency is interested in other areas such as incorporating it into design, system engineering, autonomy, and project management.

Dr. Gaskin pointed out that Fermi and Swift are very reliant on TDRSS and they are somewhat concerned about it. Dr. Clampin said Ms. Sandra Cauffman, SMD's point of contact for communications and the interface to NASA's Space Communications and Navigation (SCaN) program, is acutely aware they have a number of short- and longer-term issues with communications for a lot of missions. She is actively working for APD and the whole of the SMD, so a recommendation that APD try to work closely with SCaN to make sure these issues are addressed is welcome.

Dr. Hickox suggested that NASA get community input on Artificial Intelligence/Machine Learning (AI/ML). There is a really wide variation in expertise and experience in using these tools among the field. It would be useful for the APAC to have a presentation about it or request that the PAGs collect some input from their communities about how people are using ML. Dr. Holly-Bockelmann agreed that the PAGs are an excellent way to start. In addition, she suggested that the APAC inform themselves and get some use cases to help assemble ideas for a presentation, perhaps in October. She is also interested in thinking about a realistic analysis of what infrastructure it would take to realize many of these science cases. Dr. Clampin suggested it would be worthwhile to request a presentation from the SMD at [??] Science Group who are actively looking at this area. Also, APAC could ask someone from the Centers of Excellence group primarily comprised of JPL, Goddard, and Ames to come and give an overview of some of the areas that they are looking at outside the core science area. Dr. Ho thought it was an excellent idea because there are a lot of use cases in [drone?] development autonomy, program management, and material discovery, which is a very hot topic right now. Those topics are broader than SMD, but it would be good to bring those ideas in. Dr. Holly-Bockelmann agreed that would be a great topic for the next meeting.

Dr. Tremblay thanked Dr. Sheth and the inclusion plan pilot team for their incredible work. He noted that one of the understandable pieces of community feedback from the earlier inclusion plan workshop was to provide a template for an inclusion plan, but he credited the team for pushing back and not providing a prescription. He suggested that the APAC have the IP team present at the October meeting. Dr. Gaskin seconded what Dr. Tremblay said. She went to the inclusion plan overview and also one for the advice for PIs who needed to rewrite their inclusion plan. She found it problematic that almost all of the inclusion plans were deemed inadequate when they were not given sufficient guidance for them to succeed, and then they were asked to do it over. If the goal was to have more of a dialogue with PIs, then have that upfront and try to give them the tools they need to succeed. Dr. Holly-Bockelmann said that she learned at a lunchtime presentation that many people conflate inclusion plans with mentoring. There is information on the website that defines what one means by the word "inclusion." It would be useful for people getting ready to write an inclusion plan, to stop and think about what "inclusion" means. Dr. Gaskin agreed but

added that when everybody in the community fails, it is not a problem with the community, it is a problem with the expectations that were set. She suggested that going forward they look at how this is executed and the guidance being given to PIs.

Dr. Hickox agreed it is important to recognize the amount of work and various levels of frustration the PIs have. When he heard that most of the inclusion plans were deemed inadequate, he thought that sounded right. They probably do not know how to do this yet and it is good to hold people to standards and make them develop them. His hope is that going forward, the knowledge base and the understanding in the community and in the people at NASA will all grow together to the point where the number of inclusion plans that are acceptable will increase dramatically on the first attempt.

Dr. Gaskin said specific verbiage used was adequate and inadequate and it would probably have been more beneficial to have a bit more of a gradation than to say everybody is inadequate. Most PIs want to do inclusive things and they want to build strong teams, so looking for guidance in order to succeed is what people want.

Dr. Pascucci said it is helpful for the community to know about success stories, teams who have adopted these inclusion plans and have done very well, so that other teams can adopt some of the ideas they might not have thought about. Her main concern was that most of the inclusion plans are for three-to-five years maximum, but the long-term impact needs to be addressed.

Dr. Sheth said 80 percent of the people said the workshops were useful. Dr. Gaskin felt the webinars were mostly repeating the text in the call and were too general to help bring an inclusion plan from inadequate to adequate. Perhaps Dr. Sheth could have one-on-one discussions with PIs and go through it in more detail.

Dr. Sheth noted that the discussion sections were not meant to be webinars, but interactive one-and-a-half-hour sessions where they presented eleven slides and asked people to bring up specific issues so they could resolve as many of them as possible. They offered to have separate discussions with certain groups if they wanted. He found that most people did not respond to the six questions that were specifically stated. Also, people had a general context of what IDEA means and they confuse inclusion with diversity, broadening participation, or preparing students to become Ph.D. students. The solicitation asks for none of that. They went through a flowchart with the PIs about how to come up with an actionable item, how to make sure an actionable item addresses one of the assessment questions, how to check whether something is new or implementable or not, and what the metrics are. It is virtually impossible to give out a set of examples that will work for everybody, but it is important that the community realize that everybody has the ability to answer the questions laid out in the solicitation. In addition, the IDEA practitioners are learning how to evaluate these proposals, and their assessments were probably not on target, so they were told to use the discussion sections as guidance, not gospel, when they were given out.

Dr. Sheth disagreed that 100 percent of inadequate means they did not give out enough guidance and the community failed. He said they gave very clear guidance, but it was new to people, so most people were not able to address the solicitation properly. It is a requirement at SMD-level that funding cannot be released until the plans are made adequate. [Dr. Smith?] will be the selecting official. His job, along with Dr. Cucchiara and all the program officers, is to help get the plans over the line.

Dr. Gaskin said she appreciated how much hard work they are putting into it. She believes inclusion will make a better scientific community, so she wants this program to succeed. She asked the APAC how many people have had to write an inclusion plan for a proposal. Most of the hands went up. How many of yours were adequate? Most hands stayed up and some said they did not know.

Formulate Recommendations

Dr. Holley-Bockelmann asked the group to formulate recommendations and, given the previous discussion, she suggested the group would like to hear an update from the inclusion plan.

Dr. Hickox noted that these update requests should mostly be for a future meeting rather than a specific one. Dr. Tremblay thought it would be useful to hear about the inclusion plan in October, if it was feasible, because the probe team proposals will be in as early as November.

Dr. Pascucci pointed out that Nexus for Exoplanet System Science went through a programmatic assessment review, and there is a senior scientist position open for Astrobiology that will be filled soon. She recommended that they request a presentation on NASA's plan for astrobiology, as well as the summary of the review at the October meeting. Given that NEXUS for Exoplanet System Science recently went through a programmatic assessment review and will be filling a senior scientist position soon, Dr. Clampin suggested that the person selected to fill that position give the presentation.

In relation to the inclusion plan, Dr. Sheth added that in 2023 the inclusion plan language will change again, per SMD. Only the Astrophysics Theory Program and the APRASAT program will be asked to enter an inclusion plan. Because October will be too late for the ATP to benefit from a presentation, they are going to do a pre-proposal discussion of inclusion plans and lessons learned so people know exactly the missteps to avoid. If the APAC feels there are venues in which they should do this presentation, they can do that. But they prefer to do it in small groups because they want to encourage discussion and allow people to ask questions. Most likely, next time they are going to do the inclusion plan reviews first before they review the science plans. Again, it will be two different panels. Then they want to get the inclusion plans in the hands of the science panelists after they finish their review so they can learn as they go along. They want to encourage that interaction between the IDEA practitioners and the science reviewers. Most panels had two IDEA practitioners and one scientist, typically an astrophysicist, working together to review these assessments. Dr. Gaskin suggested that since they have already made some videos, they could put them on the links for the actual calls in that same ROSES page for each of the proposals. Dr. Sheth said that as soon as they do the pre-proposal call, they will post them. He is not allowed to give something that he has not shared first, so he wants to do the pre-proposal call, tape that, and then provide it for people who could not attend.

Dr. Holley Bockelmann asked the group for their thoughts about the TDAMM conversation at the meeting. Dr. Pascucci said one request was to have a chart with all the possible TDAMM missions and their science niche at the next meeting. Dr. Gaskin said part of the frustration in the TDAMM community is a lack of strategy going forward. They have an amazing fleet that is doing amazing science, but the fleet is aging and there is no strategy going forward. There are some short term, smaller solutions. The APAC has been asking for, but have not seen, how they are going to address the recommendations beyond just saying international partners. Dr. Holley Bockelmann said they have asked a couple of times for some sort of landscape of what TDAMM suite looks like. This time they asked them to include the international partners that they know of, what the upcoming missions look like, what probability there is for losing a fleet. They want a time-dependent global picture of where they are going to be with respect to TDAMM. She believes that Dr. Clampin understands the figures and data they want for the next meeting. Dr. Hickox would like to see a clear exposition of the exact timelines for all the different NASA and international missions. In particular, what does the community of people doing time domain and multimessenger science need going forward? He noted the MIDEX downselect coming up, and both STARx and UVEX have some time-limiting and multimessenger follow-up capability. There is also a SMEX call down the line. It would be useful for the community of people doing TDAMM science, be it in the SIG or elsewhere, to think about where they are, what the known opportunities will be, and what a framework would look like for success in terms of achieving what they need collectively. Dr. Holley-Bockelmann said that would be analysis, so they might need an analysis group.

Dr. Holley-Bockelmann noted that sometimes recommendations can be useful to show that the APAC prioritizes something if there is a funding squeeze. The ask was that APAC explicitly gives priority with respect to TDAMM, but she thought they were not ready to make such recommendation until they get more information. She asked, rather than just prioritize TDAMM, what specifically in TDAMM would you prioritize? Dr. Caputo said they need to see TDAMM turning on in the form of funding, and then the community needs to prioritize what it wants. That comes from the community, not the APAC, but the APAC needs to say that support needs to start turning on. Dr. Tremblay completely agreed — it is out of scope for the APAC, which does not push mission architectures or mission selections. But they can encourage NASA to interact with the SIG and the proposed TDAMM cross-PAG SIG. Dr. Caputo added that the community is going in this direction, but it needs to be matched on the NASA side.

Dr. Kiessling said they talked a lot about getting the status reports for HWO. One of the things they had talked about was technology roadmaps, so perhaps they could have a status update as part of the technology roadmap discussion. She thought the program officers would be really well placed to give the status and roadmap briefing. Dr. Holley-Bockelmann added that having a technical sense of where they are and what is needed to go to the next level will be useful.

Dr. Tremblay would like an APAC recommendation encouraging the HWO START and reflecting the great community response of almost 176 applications, which shows broad community excitement. There is also a lot of community excitement for HWO among early career folks, some of whom might not get a chance to participate on the START simply because they have not finished their Ph.D.s yet. It would be helpful to have an APAC recommendation that encourages the START to engage with the community as much as possible by actively engaging with the PAGs and their SIGs and SAGs, regularly inviting them to their open meetings, or other means. A broad community will be needed to support this observatory in the years and decades ahead, and a team larger than 15 people on the START would be great.

Dr. Gaskin brought up the new approach of having a number of different small missions. She noted that a flagship mission provides an expectation based on its risk class that longevity is built into it, and that longevity has been a huge benefit to the entire community for all of the flagship missions across multiple wavelengths. What is a long-term potential replacement for a flagship that no longer exists? On any strategic plan, whether it is developed within the community or at NASA, it seems there is a void in terms of a long-lived risk Class A or B mission that does not seem to be anywhere in the planning.

Dr. Holley-Bockelmann asked Dr. Clampin to expand on his request that the APAC let him know about their priorities. Did he mean advice at the level of prioritizing one wavelength over another wavelength or one program over another program? Dr. Clampin replied that first and foremost he takes direction from the Decadal survey. Typically Class A missions are flagships recommended by the National Academy in their Decadal surveys and something of that scale or class is for the next Decadal survey. He suggested the APAC could think about how to trade priorities for different parts of the TDAMM spectrum; there is a broad spectrum of things that a mission can be built for. What are the priorities and can they be filled by small missions, or do you need a class of different-sized missions? He wondered how much can be accomplished by having the community propose missions in the SMEX, Pioneer, and MIDEX rounds to those opportunities. Dr. Holley-Bockelmann replied it could be in their purview to suggest a ROSES call for a small fleet of CubeSats they are going to prioritize to fill the TDAMM void. Dr. Clampin added that given the number of opportunities there are in a decade, they are not going to say that all the SPEXs or MIDEXs are TDAMM requirements. His personal view is if the science is that compelling, it will rise to the top anyway. He also said the APAC could prioritize one waveband over another if there are places where there really are gaps.

Dr. Gaskin pointed out that now they are dealing with missions that may not be as scientifically compelling, but they provide the community with quick alerts, for example, and really enable the community. They are a harder if you are going up against a MIDEX that has very directed science, so it is potentially challenging to fill those gaps under existing infrastructure. Dr. Clampin is concerned that the fleet of missions they have now, even the small Pioneers and some CubeSats, are either monitoring or follow-up capabilities for TDAMM science. He does not know if the APAC thinks some of the smaller missions that will do similar science are fill-ins or can breach some of those capabilities. Dr. Gaskin said you have to keep launching them because a lot of them are not long lived. In the short term, some combination of small missions can do that job pretty well. The question is whether to keep launching similar missions over and over, or better missions, different missions on a regular cadence intentionally, or launch one mission that could be longer lived? That continuity is important for multimessenger and multiwavelength. Dr. Holley-Bockelmann said that from a workforce and technology perspective, it might make sense to focus on smaller missions that can fill gaps and be deliberately short-lived to respond to the new field.

Dr. Hickox noted that it is really hard to predict the lifetime of a mission, but no one wants to rely on a mission of a lower risk class living for a long time. There is a good chance that SMEX or some Pioneers could potentially last for quite a long time, but he is unsure how to plan for that given that some failures are stochastic. Perhaps they could be a bit more optimistic. Some things that are planned to not last very long might actually last a good bit longer.

Dr. Caputo said a billion-dollar mission or a very large MIDEX can support communities. They have GEO programs, they can develop pipelines, they train the next generation scientists. To replace that with CubeSats is not sustaining a community. There is not funding right now to support a larger mission, but there is pushback from the community because it was prioritized at a high funding level. They can do some aspects of this science on smaller missions, and those will be excellent training grounds for future technologists in developing the field and technology. But if they say they are only looking at smaller things in the future, the community is going to push back. Dr. Champlin is not saying they can be replaced, but to what extent.

Dr. Caputo said she does not think the community is saying they just want to replace Fermi and Swift, they would target them much better to address the science. So talking about a Fermi or Swift replacement is shorthand for saying they understand where the science is going. They would propose different missions that have different capabilities. The community is in the process of figuring out and prioritizing what it needs right now via workshops, so they have to see a commitment from headquarters that there is a purpose for this strategic planning. Nobody says they cannot define an exoplanet mission because there are so many aspects, like direct imaging, radio velocity, microlensing. Just do the whole suite. It is the same for TDAMM.

Dr. Holley-Bockelmann said when they do not have enough money, the data they prioritize is a valid question for the community. There are ways to help set this priority. She noted they have asked for some information for the next meeting. There is a SIG, but she wondered if they should make a SAG that would actually provide analysis. Dr. Tremblay suggested the SIG should decide whether or not a SAG would be appropriate. He thinks a SAG would always be useful, but he is sympathetic to the community. Everyone is busy and pressed for time and it is an all-volunteer effort. Dr. Clampin reminded the group that the Decadal survey did not identify it as a flagship-class science mission, so coming back and saying they need to build a Class A, Class B, or TDAMM mission is not going to sell with their stakeholders. Dr. Gaskin said they said $500-$800 million, so it could be a portfolio.

Dr. Tremblay opened a new topic. The next deliverable for the Athena Science Redefinition team is a report to ESA's advisory structure, formerly the SPC, in October. He suggested they have another

presentation on the status of New Athena by the March meeting. Their deliverable after the SPC is a set of science requirements. NASA has a contribution to Lisa and Athena and both are CAC cost at completion, capped missions at €1.3 billion. It would be good to get an update, perhaps yearly, on the status of Lisa and Athena and NASA's planned contributions to both.

Dr. Hickox said they had had a brief discussion about FINESST, the graduate student research program, the previous day. While he applauds the significant increase in funding for the program, he is concerned that the selection rate is still quite low. It is comparable to NSF, but it is still 13 percent, which seems lower than they would like. They are in a budget-constrained environment, but he would like the funding to be at least raised to keep the selection at that level. Dr. Pascucci requested that the future presentations on the selection rate for FINESST, they split it by division because there are differences. Dr. Tremblay reminded the group that they had asked for a datacube on FINESST selection rates, like Dr. Pascucci requested, but also broken down by what fraction of R1 institutions or MSIs are getting them. He would like to get that next time. The question came up whether FINESST was dual anonymous or had any plans to be in the future. They will have a discussion about that in the future.

Dr. Hickox returned to the topic of ensuring that Euclid's data archives and analysis tools are fully interoperable with Roman and Rubin. There is a lot science focusing on the synergies between Roman, Rubin, and Euclid, so they have to start now to make sure those architectures are developed in such a way that the data can be analyzed together.

Dr. Hickox recommended that NASA work on figuring out how to coordinate the first year or cycle of GEO observations of IXPE with other observatories. To maximize IXPE science and its unique capability other x-ray observatories have to be going at the same time. Dr. Tremblay asked that when they talk about adding more coordinated time across multiple observatories, is it within APAC's scope to make a recommendation that NASA encourage it, or should it be the science center or the director of the individual observatories? Dr. Smith said it depends on the observatory. Hubble/Webb are under the purview of the Space Telescope Science Institute, so their user committee makes recommendations like that for them. Ground-based observatories are similar, but the APAC can encourage them to explore coordination. There are clearly a lot of constraints and it is not appropriate to be telling anybody to use their time in a particular way. But they may not fully appreciate that this opportunity is there and that to make full use of this resource, they may need this coordination. Dr. Holley-Bockelmann said they could say that APAC recommends that they explore opportunities for increased coordination. Dr. Hickox was particularly thinking about IXPE, given that it is undergoing a quick switch to developing a new GEO program. To do its full science it is reliant on other x-ray observatories to be doing simultaneous observations. He recommended that APAC suggest exploring x-ray or other space-based observatories sharing coordinated observations with IXPE.

Dr. Caputo said there was a request to get a response from APD regarding the Senior Review Overguide request for an IDEA consultant. Dr. Kiessling added that it was specifically for all Goddard-led missions and she thinks that if there is a consultant coming in, then it would be great to have it available to all missions. Dr. Smith informed the committee that he ran the Senior Review and the panel was not certain that the individual Goddard talked about hiring was the best way to achieve the DEIA goals they were seeking. They said it was laudable to do it, and they put in the letters to some of the programs' suggestions about how they could improve their performance in that area. One of the observatories had performance measurement objectives (PMOs). Putting something like that in for an observatory is a direct way to say, here is what we are going to do and measure it next time. So, while they said hiring a consultant is an interesting idea, some on the panel said were not certain that was the best way to achieve their goals.

Dr. Bindu Rani asked Dr. Hickox what he thinks should be included and done together when he uses the words "coordinated observations." She noted that he stressed the coordinated observations with IXPE, and NISAR is already putting a call together with IXPE. Dr. Hickox said NISAR has 300 kiloseconds dedicated to coordinated observations, so that is exactly the type of thing they would like other missions to make available. Just by its nature, NISAR is pretty flexible in terms of scheduling, but it would be harder for bigger, less agile observatories or those whose schedules are already packed. But depending on how long the IXPE GEO cycle lasts, it could be considered by the other x-ray observatories, like the Swift, NuSTAR, XMM genre. He imagines XRISM could provide some amazing, coordinated observations with IXPE as well, although that may be down the line.

Dr. Caputo has been interested in seeing if there was additional data indicating that for R&A programs people would be interested in analyzing and using the open data. Dr. Hickox said it would differ by R&A program. For ADAP or ATP there may be a lot of data that people would want to use, whereas for technology development, maybe not as much. Dr. Caputo said it would be useful to help guide the program in the community to say what they are asking of teams.

Dr. Pascucci returned to the prior recommendation that the information on the length or lack of proprietary time be kept confidential from the TAC, including the default exclusion time. Dr. Holley-Bockelmann restated their recommendation that the information about whether a person wants or does not want proprietary time be kept from the TAC. They understand proprietary time can be given if requested. But sometimes people are afraid to request it. Dr. Smith said this is not a recommendation for NASA but should be taken up with the JWST and HST user committees. The APAC can contact the chairs of those user committees. Dr. Kiessling expressed concern that the recommendation does not have peer review of the request. If somebody is asking for additional proprietary time, she would like there to be peer review of the validity of that requirement. Dr. Holley-Bockelmann said that will still happen based on what they are going to tell them they want them to do. She then asked Dr. Smith if there was an APV head of the user committees. He replied that the Institute was set up specifically to have an independent organization from the government.

Dr. Hickox expressed concern about TDRSS and communications more generally, given the fact they are in the middle of a LIGO run. There will be a VLK run and upcoming runs like that, so he wants to make sure they have a fast response capability going forward. Dr. Clampin said they will continue to advocate for APD missions with SCAN, especially in regard to TDRSS. The damage on Guam is pretty extensive and there is stress on the networks to fill the gaps. Dr. Holley-Bockelmann suggested they stress that this communication in general is broader than APD, broader than SMD. Dr. Tremblay added that DSN is having problems, too, and suggested they have a presentation from the SCAN crew to get a current picture on the future of space as they keep adding observatories to L2 and Artemis. Dr. Clampin said somebody from SCAN can talk about the view ahead at the next meeting.

Dr. Clampin thanked the committee for the discussion and advice and finished up with some good news: Dr. Jane Rigby had been appointed as the new senior scientist for the JWST. Dr. Mather stepped down after 28 years as the senior project scientist and will serve as the Webb senior emeritus scientist.

Dr. Hasan thanked Dr. Holley-Bockelmann and the APAC members who attended in person and virtually, along with the speakers who gave presentations.

Dr. Holley-Bockelmann thanked the presenters, the public, and the committee members.

Adjourn

The meeting was adjourned at 3:40.

Appendix A
Participants

Committee members
Dr. Holley-Bockelmann, Vanderbilt University, *Chair, Astrophysics Advisory Committee*
Hashima Hasan, NASA Astrophysics Division, Science Mission Directorate, *Executive Secretary*
Daniella Calzetti, University of Massachusetts
Dr. Caputo, NASA – Goddard Space Flight Center
Hsiao-Wen Chen, Kavli Institute for Cosmological Physics
Jessica Gaskin, NASA – Marshall Space Flight Center
Erika Hamden, Steward Observatory
Ryan Hickox, Dartmouth College
Shirley Ho, Flatiron Institute
Shardha Jogee, University of Texas at Austin
Alina Kiessling, NASA Jet Propulsion Laboratory
Mark Mozena, Planet Labs Inc.
Ilaria Pascucci, University of Arizona
Grant Tremblay, Harvard-Smithsonian Center for Astrophysics

NASA
Mark Clampin,
Director, APD
Lorella Angelini
DAVID ARDILA
Vanessa Bailey
Catherine Barclay
Manuel Bautista-Plaza
Dominic Benford
Gary Blackwood
Jenna Cann
Regina Caputo
Sandra Cauffman
Stephen Cenko
Francesca Civano
Stephanie Clark
Rachele Cocks
Valerie Connaughton
Dave Content
Julie Crooke
Antonio Cucchiara
Doris Daou
Jason Derleth
TERENCE DOIRON
Shawn Domagal-Goldman
Ingrid Farrell
Alise Fisher
Galen Fowler
Ronald Gamble
Opher Ganel
Michael Garcia
Jessica Gaskin
Grace Gouin
Brian Grefenstette
Edwin Griego
Thomas Hams
Hashima Hasan
Executive Secretary, APAC
Elizabeth Hays
Paul Hertz
Brianna Hobert
Jennifer Holt
Michelle Hui
Mia Humberd-Hilf
Stefan Immler
Philip Kaaret
Richard Kelley
Alina Kiessling
Pamela King-Williams
Patricia Knezek
Daniel Kocevski
Peter Kurczynski
William Latter
DAVID LEISAWITZ
Janet Letchworth
Sangeeta Malhotra
Pamela Marcum

Mark Matsumura
Julie McEnery
Shouleh Nikzad
Roopesh Ojha
Lucas Paganini
Tyler Parsotan
Joshua Pepper
Mario Perez
Jeremy Perkins
Rob Petre
Natasha Pinol
Naseem Rangwala
Bindu Rani
James Rhoads
Norman Rioux
Rachel Rivera
Aki Roberge
Rhiannon Roberts
Jenna Robinson
Andrew Rowe
Rita Sambruna
Paul Scowen
Diana Scognamiglio
Kartik Sheth
Nicholas Siegler
Miles Skow
Eric Smith
Linda Sparke
H. Philip Stahl
Karl Stapelfeldt
Amber Straughn
Anita Thompson
Maggie Beth Turcotte
Sanaz Vahidinia
Brenna Wells
Brian Williams
Joyce Winterton
JENNIFER WISEMAN
John Wisniewski

Non-NASA/Unknown

Amethyst Barnes
Marufa Bhuiyan
Brad Cenko
Haeun Chung
Stephen Clark
Jonathan Crass
Etienne Dauvergne
M. Diaz
Monty Di Biasi
Tammy Dickinson
Conner Davis Ebeyer
Sylvie Espinasse
Mike Fanelli
M. Fausnaugh
Justin Fin
Kinsey Flanders
Karl Forster
Jeff Foust
Abraham Mateos Gallego
Zhaoming Gan
Lewis B. Groswald
Alexandra Greenbaum
Brian Grefenstette
Roberto Guenzani
Erika Hamden
Maria Babiuc Hamilton
Sharon Hannon
Sara Heap
Ryan Hickox
Shirley Ho
Kelly Holley-Bockelmann
Chair, APAC
Teresa Jensen
Shardha Jogee-Bromm
Jompoj
Steve Kendrick
Kelsie Krafton
Cathirame Lee
James Lochner
Emma Marcucci
Stephan McCandliss
Gene Mikulka
Ruth Nichols
John O'Meara
Ilaria Pascucci
Parshad Patel
Swara Ravindranath
Amy Reis
Jamie Riggs
Pascal Ripoche
Richard Rogers
Nick Saab
Wilton Sanders
Marcia Smith
Jessica Stasik
Nao Suzuki

Harvey Tananbaum
Alan Thurgood
David Traore
Grant Tremblay
Terry Trevino
Lasata Tuladhar
Roland Vanderspek
Gopal Vasudevan
Peter Veres
Nicholas White
Andrew Williams
Erik Wilkinson
Santosh Yadav

Appendix B
Astrophysics Advisory Committee Members

Dr. Holley-Bockelmann, Chair, Astrophysics Advisory Committee
Vanderbilt University

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

Daniella Calzetti
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Dr. Caputo Caputo
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Hsiao-Wen Chen
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Jessica Gaskin
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Erika Hamden
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Shirley Ho
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Shardha Jogee
University of Texas at Austin

Alina Kiessling
NASA Jet Propulsion Laboratory

Mark Mozena
Planet Labs Inc.

Ilaria Pascucci
University of Arizona

Grant Tremblay
Harvard-Smithsonian Center for Astrophysics

Appendix C
Presentations

NASA Astrophysics Update, Mark Clampin
Roman Space Telescope Project Status, Julie McEnery
GOMAP Update, Julie Crooke, Shawn Domagal-Goldman
Time-Domain Multi-Messenger Astronomy Update, Valerie Connaughton
Fermi Gamma-ray Telescope Mission Update, Elizabeth Hays
Neil Gehrels Swift Observatory Update, Brad Cenko
NuSTAR Status Update, Brian Grefenstette
NASA Support for Open Science Activities, Roopesh Ojha
Cosmic Origins Program Analysis Group (COPAG) Report, Shouleh Nikzad
Physics of the Cosmos Program Analysis Group (PhysPAG), Justin Finke
Exoplanet Program Analysis Group (ExoPAG) Report, Ilaria Pascucci
First Science Results From the Imaging X-ray Polarimetry Explorer (IXPE), Philip Kaaret
TDAMM SIG Terms of Reference (Draft)
Exploring the Complementary Science Value of Starshade Observations SAG Terms of Reference (Draft)

Appendix D
Agenda

Astrophysics Advisory Committee
Virtual
June 27-28, 2023

Tuesday, June 27

9:00 a.m.	Introduction and Announcements	Hashima Hasan/Dr. Holley-Bockelmann
9:05 a.m.	Astrophysics Division Update	Mark Clampin
11:00 a.m.	Discussion	APAC members
11:30 a.m.	Roman Update	Julie McEnery
12:00 p.m.	Lunch	
1:15 p.m.	Great Observatories Maturation Program	Julie Crooke/Shawn Domagal-Goldman
1:45 p.m.	Discussion	APAC members
2:00 p.m.	Time Domain Multi-Messenger Astronomy	Valerie Connaughton
2:30 p.m.	Discussion	APAC members
3:00 p.m.	Break	
3:15 p.m.	Fermi Update	Elizabeth Hays
3:45 p.m.	Swift Update	Brad Cenko
4:15 p.m.	NuSTAR Update	Brian Grefenstette
4:50 p.m.	Public Comment Period	
5:00 p.m.	Wrap up for Day 1	Dr. Holley-Bockelmann

Wednesday, June 28

9:00 a.m.	Opening Remarks	Hashima Hasan/Dr. Holley-Bockelmann
9:10 a.m.	Year of Open Science Update	Roopesh Ojha
9:40 a.m.	Discussion	APAC members
10:10 a.m.	COPAG/PhysPAG/ExoPAG Discussion	Shouleh Nikzad/Justin Finke/Ilaria Pascucci
10:40 a.m.	Discussion	APAC members
11:50 a.m.	Public Comment Period	
12:00 p.m.	Lunch	
12:15 p.m.	First Science Results from IXPE	Philip Kaaret
1:15 p.m.	Discussion	APAC members
2:30 p.m.	Formulate Recommendations	APAC members
3:30 p.m.	Debrief Division Director	APAC members
4:00 p.m.	Adjourn	

Appendix E
WebEx Chat Transcripts

Chat Day One

from Rita Sambruna she/hers (Ext) to Everyone: 9:00 AM
we dont hear anything

from Marufa Bhuiyan (Ext) to Everyone: 9:01 AM
Good morning

from Patricia Knezek (Ext) to Everyone: 9:01 AM
I can hear Hashima.

from Rita Sambruna she/hers (Ext) to Everyone: 9:01 AM
now we can

from Dr. Holley-Bockelmann (Ext) to Everyone: 9:01 AM
We're dealing with echos

from Patricia Knezek (Ext) to Everyone: 9:01 AM
Okay, thanks, Dr. Holley-Bockelmann .

from Marufa Bhuiyan (Ext) to Everyone: 9:01 AM
Eid Mubarak!

from Dr. Holley-Bockelmann (Ext) to Everyone: 9:02 AM
Can you still hear?

from Patricia Knezek (Ext) to Everyone: 9:02 AM
Yes.

from Dr. Holley-Bockelmann (Ext) to Everyone: 9:02 AM
Perfect!

from Marufa Bhuiyan (Ext) to Everyone: 9:03 AM
Yes, I can hear very well

from Dr. Holley-Bockelmann (Ext) to Everyone: 9:40 AM
hang on, Jessica -- waiting for a pause

from Shawn Domagal-goldman he/him (Ext) to Everyone: 9:41 AM
We hear Jessica on the remote side.

from Francesca Civano (Ext) to Everyone: 9:41 AM
we can hear Jessica online

from Stephan McCandliss (Ext) to Everyone: 9:42 AM
Good question!!!

from Opher Ganel (Ext) to Everyone: 9:43 AM
I believe it includes SAT, ISFM, and SMTP.

from Jessica Gaskin (Ext) to Everyone: 9:44 AM
Thanks Opher!

from Dr. Holley-Bockelmann (Ext) to Everyone: 9:58 AM
Shardha, is this a new hand?

from Shawn Domagal-goldman he/him (Ext) to Everyone: 10:10 AM
We can hear you online.

from Patricia Knezek (Ext) to Everyone: 10:10 AM
Can you hear me?

from Aki Roberge (Ext) to Everyone: 10:10 AM
We can hear Pat online

from Rita Sambruna she/hers (Ext) to Everyone: 10:10 AM
we can hear you online

from Marufa Bhuiyan (Ext) to Everyone: 10:11 AM
Yes

from Rita Sambruna she/hers (Ext) to Everyone: 10:19 AM
the audio is breaking down

from Manuel Bautista-Plaza (Ext) to Everyone: 10:27 AM
the audio became pretty bad

from Shawn Domagal-goldman he/him (Ext) to Everyone: 10:33 AM
can't hear Mark at all right now

from Rita Sambruna she/hers (Ext) to Everyone: 10:33 AM
no sound

from Patricia Knezek (Ext) to Everyone: 10:34 AM
Can't hear Mark if he's talking.

from Aki Roberge (Ext) to Everyone: 10:34 AM
Is Mark talking?

from Patricia Knezek (Ext) to Everyone: 10:34 AM
Okay, can hear him now, thanks.

from Dr. Holley-Bockelmann (Ext) to Everyone: 10:34 AM
Sorry about that -- thanks for speaking up, y'all

from Patricia Knezek (Ext) to Everyone: 10:54 AM
FYI, it's really important to speak into the mics in the room. People keep dropping in and out.

from Marufa Bhuiyan (Ext) to Everyone: 10:54 AM
Great question regarding NASA TOPS program

from Doris Daou (Int) to Everyone: 10:56 AM
Sorry folks it is difficult to hear. But I confirm what Linda has explained regarding ADAP/Euclid.

from Marufa Bhuiyan (Ext) to Everyone: 11:16 AM
How long is break? Sorry I missed it. I see in the agenda lunch from 12:00-1:15pm.

from Santosh Yadav (Ext) to Everyone: 11:16 AM
hello

from Santosh Yadav (Ext) to Everyone: 11:17 AM
congratulations to NASA scientists

from Santosh Yadav (Ext) to Everyone: 11:17 AM
and giving us golden opportunity to us

from Rita Sambruna she/hers (Ext) to Everyone: 11:21 AM
and people look away from the mic when they speak

from Alina Kiessling (Ext) to Everyone: 11:21 AM
@Marufa - break will end at 11:25am ET

from Francesca Civano (Ext) to Everyone: 11:21 AM
it is a bitty choppy even now

from Marufa Bhuiyan (Ext) to Everyone: 11:22 AM
Thanks @Alina

from Karl Stapelfeldt (Ext) to Everyone: 11:22 AM
The connection is fine. The mike is not.

from Karl Stapelfeldt (Ext) to Everyone: 11:23 AM
Speak loudly and directly to the mike.

from Karl Stapelfeldt (Ext) to Everyone: 11:27 AM
No

from Francesca Civano (Ext) to Everyone: 11:28 AM
we can

from Francesca Civano (Ext) to Everyone: 11:28 AM
we can hear her

from Pascal Ripoche (Ext) to Everyone: 11:28 AM
yes

from Erika Hamden (Ext) to Everyone: 11:29 AM
It would be good to have her say a paragraph or something just to double check

from Erika Hamden (Ext) to Everyone: 11:29 AM
Yes, please recite poetry to us!

from Marufa Bhuiyan (Ext) to Everyone: 11:29 AM
A poem would be nice. haha

from Erika Hamden (Ext) to Everyone: 11:29 AM
But it does sound good now

from Francesca Civano (Ext) to Everyone: 11:29 AM
it is good we can hear you well

from Rita Sambruna she/hers (Ext) to Everyone: 11:47 AM
Pat your mic is open

from Kartik Sheth (Ext) to Everyone: 11:47 AM
Hot mic - Pat

from Kartik Sheth (Ext) to Everyone: 11:48 AM
Let me see if I can text Pat

from Patricia Knezek (Ext) to Everyone: 11:49 AM
Sorry, all!

from Kartik Sheth (Ext) to Everyone: 12:07 PM

Not sure I want to convey that message @Dominic - in fact much of the community has done a good job at IPs. We want to simply take them to the next step!

from Francesca Civano (Ext) to Everyone: 12:08 PM

What time are you resuming? the mic was muted before the end of the sentence

from Dr. Holley-Bockelmann (Ext) to Everyone: 12:08 PM

1:15 Eastern time

from Francesca Civano (Ext) to Everyone: 12:08 PM

thank you Dr. Holley-Bockelmann !

from Dr. Holley-Bockelmann (Ext) to Everyone: 12:09 PM

Sorry -- it was me who chopped off my own words, thinking how to say 15 minutes past not the next hour but the hour after that. Ahem.

from Rita Sambruna she/hers (Ext) to Everyone: 1:16 PM

Shawn speak in the mic please

from Patricia Knezek (Ext) to Everyone: 1:18 PM

Much better!

from Mia Humberd-Hilf (Ext) to Everyone: 1:18 PM

Much better!

from Wilton Sanders (Ext) to Everyone: 1:18 PM

much better

from Gary Blackwood (Ext) to Everyone: 1:46 PM

"implementation" on this chart = formulation+ implementation, in -speak

from Dr. Holley-Bockelmann (Ext) to Everyone: 1:52 PM

I see you, Jessica -- you're 3rd.

from Jessica Gaskin (Ext) to Everyone: 1:53 PM

Thanks Dr. Holley-Bockelmann !

from Marufa Bhuiyan (Ext) to Everyone: 2:01 PM

Question: Those who are contributed authors in Decadal survey, are they alreay in HWO group? Mahalo!

from Marufa Bhuiyan (Ext) to Everyone: 2:02 PM

already*

from Kartik Sheth (Ext) to Everyone: 2:04 PM

Ithink Valerie needs to be host to share I think

from Nicholas White (Ext) to Everyone: 2:10 PM

The special issue has page charges, will NASA pay for these?

from Dr. Holley-Bockelmann (Ext) to Everyone: 2:10 PM

Interesting point. I'll elevate that.

from Rita Sambruna she/hers (Ext) to Everyone: 2:14 PM

the TDAMM workshop white paper had specific findings about DEIA

from Nicholas White (Ext) to Everyone: 2:22 PM

Thanks! Here is the text from the email

from Nicholas White (Ext) to Everyone: 2:22 PM

As publishing fees should not be a barrier to publishing, Frontiers has a Fee Support program. Authors can apply on the basis of their financial grounds and fill the form online (4) immediately after submission. Every Fee Support request is evaluated and any interested contributor is encouraged to apply. On average it takes up to a week for Frontiers to review and reply to a Fee Support request. In addition, Frontiers has numerous institutional agreements (5) around the world that might help fully or partially cover the costs.

Thank you very much and we look forward to have you as one of the contributors.

Best, Rita Sambruna and Francesca Civano

from Francesca Civano (Ext) to Everyone: 2:24 PM

Frontiers has a fess support program and you can apply for it through their portal.

from Francesca Civano (Ext) to Everyone: 2:24 PM

they might wave your fee or give you a discount but it is not up to me or Rita.

from Shouleh Nikzad (Ext) to Everyone: 2:33 PM

can you comment on UVEX in the TDAMM landscape compared to ULTRASAT

from Dr. Holley-Bockelmann (Ext) to Everyone: 2:33 PM

will ask this, Shouleh

from Brian Grefenstette (Ext) to Everyone: 2:41 PM

We lost audio from the room

from Dr. Holley-Bockelmann (Ext) to Everyone: 2:43 PM

can you hear now?

from Patricia Knezek (Ext) to Everyone: 2:44 PM

yes

from Rita Sambruna she/hers (Ext) to Everyone: 2:52 PM

but TDAMM is not going to be a priority for choosing missions

from Marufa Bhuiyan (Ext) to Everyone: 3:47 PM
If there's a storm in Guam or power outage, how do we bridge the gap in real-time data?

from Brian Grefenstette (Ext) to Everyone: 3:49 PM
Hear you 555 online

from Shouleh Nikzad (Ext) to Everyone: 3:51 PM
there will be a test at the end of the talk

from Dr. Holley-Bockelmann (Ext) to Everyone: 3:51 PM

from Brad Cenko (Ext) to Everyone: 4:37 PM
Swift has no propulsion, just fyi :)

from Jeremy Perkins (Int) to Everyone: 4:48 PM
Can folks use their mics? It's hard to hear the conversation.

from Jeremy Perkins (Int) to Everyone: 4:50 PM
So much better. Thank you.

Chat day two

from Dr. Holley-Bockelmann (Ext) to Everyone: 9:00 AM
Good morning, NASA-fans! We are ready for another day of information and deliberation!

from Marufa Bhuiyan (Ext) to Everyone: 9:00 AM
Aloha from Hawaii! It's not morning yet!

from Marufa Bhuiyan (Ext) to Everyone: 9:00 AM
lol

from Dr. Holley-Bockelmann (Ext) to Everyone: 9:00 AM
OOF, you are dedicated!

from Marufa Bhuiyan (Ext) to Everyone: 9:01 AM
Thank you haha

from Marufa Bhuiyan (Ext) to Everyone: 9:01 AM
Great to see you again this year

from Marufa Bhuiyan (Ext) to Everyone: 9:03 AM
Yesterday's public perios comment was not too long

from Marufa Bhuiyan (Ext) to Everyone: 9:03 AM

period*

from Marufa Bhuiyan (Ext) to Everyone: 9:14 AM

I'm curious to see who asks question after this talk.

from Doris Daou (Ext) to Everyone: 9:23 AM

By the way. Audio is great. Splendid job Ingrid and Pam. You fixed it.

from Jessica Gaskin (Ext) to Everyone: 10:10 AM

Thanks Dom...that makes sense...

from Jessica Gaskin (Ext) to Everyone: 10:11 AM

I like the idea of using abstracts...maybe that could work?

from Patricia Knezek (Ext) to Everyone: 10:12 AM

Going forward, SMD will be providing "core services," and one of those will be to host and serve scientifically useful R&A data. That might help for those who would like to reuse it.

from Jeremy Perkins (Int) to Everyone: 10:15 AM

We don't see the slides.

from Erika Hamden (Ext) to Everyone: 10:15 AM

There are no slides on the webex

from Patricia Knezek (Ext) to Everyone: 10:15 AM

Don't see anything

from Francesca Civano (Ext) to Everyone: 10:16 AM

we dont see the slides

from Steve Kendrick (Ext) to Everyone: 10:16 AM

can't see slides

from Stephan McCandliss (Ext) to Everyone: 10:16 AM

slides please...

from Shouleh Nikzad (Ext) to Everyone: 10:16 AM

are you sharing?

from Dr. Holley-Bockelmann (Ext) to Everyone: 10:16 AM

hang on -- we are fixing

from Jeremy Perkins (Int) to Everyone: 10:16 AM

Thank you.

from Francesca Civano (Ext) to Everyone: 10:18 AM
success!

from Stephan McCandliss (Ext) to Everyone: 10:18 AM
!!!

from Francesca Civano (Ext) to Everyone: 10:19 AM
now we cant see you anymore but it is ok

from Francesca Civano (Ext) to Everyone: 10:20 AM
audio is bad

from Marufa Bhuiyan (Ext) to Everyone: 10:20 AM
May panel lshould turn their video pn

from Marufa Bhuiyan (Ext) to Everyone: 10:21 AM
panelist video is off so we can't see who's talking

from Francesca Civano (Ext) to Everyone: 10:21 AM
still bad

from Dr. Holley-Bockelmann (Ext) to Everyone: 10:24 AM
oh no...our hacky solution is no longer satisfying to the IT person. so now we have to fix it properly

from Shouleh Nikzad (Ext) to Everyone: 10:39 AM
audio is still bad

from Shouleh Nikzad (Ext) to Everyone: 10:39 AM
really can't hear

from Jessica Gaskin (Ext) to Everyone: 10:39 AM
Thanks Gary!

from Shouleh Nikzad (Ext) to Everyone: 10:40 AM
also no video of the room

from Shouleh Nikzad (Ext) to Everyone: 10:41 AM
can't ummute myself

from Stephan McCandliss (Ext) to Everyone: 10:42 AM
we see them online and can hear Shouleh ...

from Marufa Bhuiyan (Ext) to Everyone: 11:08 AM

I think, INGRID FARREL (Host) is locked at the Webex main stage. If that person turns on their video, we can see the view of the conference room. Thanks

from Stephan McCandliss (Ext) to Everyone: 11:17 AM
should we all log out and restart the webex???

from Shouleh Nikzad (Ext) to Everyone: 11:17 AM
is there anything happening?

from Marufa Bhuiyan (Ext) to Everyone: 11:17 AM
Echo

from Shouleh Nikzad (Ext) to Everyone: 11:17 AM
we hear hear hear hear hear

from Patricia Knezek (Ext) to Everyone: 11:17 AM
Here lots of echoing.

from SANDRA CAUFFMAN (Int) to Everyone: 11:18 AM
There is a terrible echo

from Doris Daou (Ext) to Everyone: 11:18 AM
Echoooo echooooo

from Marufa Bhuiyan (Ext) to Everyone: 11:18 AM
cellphone number, is echoing endlessly haha

from Doris Daou (Ext) to Everyone: 11:18 AM
The needle is stuck on the disk.

from Patricia Knezek (Ext) to Everyone: 11:18 AM
Indeed!

from Eric Smith (Int) to Everyone: 11:19 AM
Good beat, easy to dance to, I give it a 6/10.

from Patricia Knezek (Ext) to Everyone: 11:19 AM
I feel like I'm listening to a 70s record!

from Marufa Bhuiyan (Ext) to Everyone: 11:19 AM
haha

from Doris Daou (Ext) to Everyone: 11:20 AM
I’m waiting for the video before giving it score.

from Ronald Gamble (Int) to Everyone: 11:20 AM
Its the "Astro House Music Mix" APAC edition

from Marufa Bhuiyan (Ext) to Everyone: 11:20 AM
audio is good now

from Marufa Bhuiyan (Ext) to Everyone: 11:21 AM
yes

from Francesca Civano (Ext) to Everyone: 11:23 AM
and we cannot see anything as well

from PAMELA KING-WILLIAMS (Int) to Everyone: 11:23 AM
We are still working on a technical issue. So sorry for the delay. We will let you know when it is done.
from Marufa Bhuiyan (Ext) to Everyone: 11:40 AM

We understand that University of Hawaii is trying to remove it's affiliation from Mauna Kea observatory facilites. If it does, then how would Exoplanet research move forward? It seems Hawaii Governor is interested in focusing on IRTF and Keck.

from Jessica Gaskin (Ext) to Everyone: 11:44 AM
conditional approval?

from Marufa Bhuiyan (Ext) to Everyone: 11:54 AM
I can't unmute

from Marufa Bhuiyan (Ext) to Everyone: 11:54 AM
sorry

from Marufa Bhuiyan (Ext) to Everyone: 11:55 AM
I'm joining from phone

from Brian Grefenstette (Ext) to Everyone: 1:39 PM

Can't hear Jessica online, either.

from Jessica Gaskin (Ext) to Everyone: 1:40 PM

I concur...am good with the new terms

from Shawn Domagal-goldman he/him (Ext) to Everyone: 1:40 PM

now we can hear Jessica online!

from Shawn Domagal-goldman he/him (Ext) to Everyone: 1:43 PM

"What Julie said!" (I had raised my hand to make the same point)

from Dr. Holley-Bockelmann (Ext) to Everyone: 1:44 PM

I'll keep looking for your hand, Shawn

from Blackwood, Gary (Ext) to Everyone: 1:53 PM

we can't hear julie

from Brian Grefenstette (Ext) to Everyone: 1:53 PM

We can't hear the response

from Blackwood, Gary (Ext) to Everyone: 2:00 PM

@shawn, good point. for example, how many new graduates come into our astrophysics field each year?

from Dr. Holley-Bockelmann (Ext) to Everyone: 2:01 PM

Ok, you're next, Jessica!

from Shawn Domagal-goldman he/him (Ext) to Everyone: 2:04 PM

sorry that was my pantomiming "my hand is back down now"

from Shawn Domagal-goldman he/him (Ext) to Everyone: 2:10 PM

I'm still here but will go off camera unless/until we come back to GOMAP/HWO things

from Francesca (Ext) to Everyone: 2:12 PM

It is a draft of the TDAMM SIG TOR and your comments are welcome.

from Dr. Holley-Bockelmann (Ext) to Everyone: 2:12 PM

Thanks, Francesca!

from Kartik Sheth (Ext) to Everyone: 2:21 PM

@Grant - Thank you!

from Dominic Benford (Int) to Everyone: 2:24 PM

May I adjust my statement from yesterday? I fully recognize that there are great and sincere efforts in the APRA and Roman Inclusion Plans, and we *do* want to have a dialog with everyone. And we've been having webinars with the PIs to do what Dr. Caputo just said.

from Kartik Sheth (Ext) to Everyone: 2:24 PM

Not sure who was speaking - and we have done 4 1.5hr workshops, send out the video, sent out the slides - so I don't understand the person who was speaking saying we don't have enough guidance for people to make their plans adequate?

from Dominic Benford (Int) to Everyone: 2:25 PM

Oh, please don't think that the IPs being judged "inadequate" implies that they "fail". Some are very good. We just want to talk with *everyone*.

from Kartik Sheth (Ext) to Everyone: 2:25 PM

I disagree with the speaker but can discuss it more fully at the October meeting

from Dominic Benford (Int) to Everyone: 2:25 PM

Also, *nobody* was declined on the basis of the Inclusion Plans.

from Kartik Sheth (Ext) to Everyone: 2:26 PM

Does the 20% of the acceptance rate of successful PIs means 80% are not getting sufficient guidance

from Kartik Sheth (Ext) to Everyone: 2:28 PM

Thank you - is that Ryan ? 100%

from Alina Kiessling (Ext) to Everyone: 2:28 PM

Dara Norman gave a great talk to the APAC a year ago about how to do a little better in inclusion plans, with clear examples: https://science.nasa.gov/files/science-red/s3fs-public/atoms/files/Norman_APAC%20JUly%202020.pdf

from Kartik Sheth (Ext) to Everyone: 2:28 PM

We did not have a choice with Adequate vs Inadequate - SMD decision.

from Kartik Sheth (Ext) to Everyone: 2:29 PM

Happy to speak if people want?

from Dr. Holley-Bockelmann (Ext) to Everyone: 2:29 PM

Give us a sec

from Dominic Benford (Int) to Everyone: 2:30 PM

Kartik is a better speaker on this than I!

from Kartik Sheth (Ext) to Everyone: 2:37 PM

Thanks!

from Kartik Sheth (Ext) to Everyone: 2:37 PM

We want your help@!

from Kartik Sheth (Ext) to Everyone: 2:38 PM

Please help us tell the community - this will be tough but that doesn't mean they are failures - i mean i know egos are fragile but that is the way it is

from Kartik Sheth (Ext) to Everyone: 2:38 PM

It is in the solicitiation!

from Kartik Sheth (Ext) to Everyone: 2:38 PM

Honeslty I don't think people read the solicitation carefully

from Dominic Benford (Int) to Everyone: 2:39 PM

I'll reiterate - "inadequate" shouldn't be taken to mean "bad". We just want to talk to everyone for uniform information.

from Kartik Sheth (Ext) to Everyone: 2:39 PM

Does the Inclusion Plan provide adequate processes and goals for creating a positive and inclusive working environment for the investigation team?

Does the Inclusion Plan include ways in which this positive and inclusive working environment will be maintained? For instance, are the Plan’s metrics of success and associated assessment plans adequate for gauging progress towards creating and sustaining the inclusive environment?

Does the Inclusion Plan demonstrate awareness of systemic barriers and ideas for removing these to create inclusive working environments?

Does the Inclusion Plan adequately describe the contribution of the proposed investigation to the training and development of a diverse and inclusive team?

Does the Inclusion Plan provide an adequate plan for achieving the identified contribution? Is the Plan likely to be successful in realizing the identified contribution?

Do the efforts in the Inclusion Plan have clearly stated goals, actions to achieve those goals, and m

from Kartik Sheth (Ext) to Everyone: 2:40 PM

We can do it in October!

from Kartik Sheth (Ext) to Everyone: 2:40 PM

Can I make one more comment real quick

from Shouleh Nikzad (Ext) to Everyone: 2:40 PM

those of us online are at a disadvantage since we don't have video (collective or individual) and speakers don't identify themselves

from Shouleh Nikzad (Ext) to Everyone: 2:41 PM

individual videos?

from Jessica Gaskin (Ext) to Everyone: 2:45 PM

Got ya!

from Kartik Sheth (Ext) to Everyone: 2:39 PM

here were the assessment criteria. Really we just want people to respond to these 6 questions with actions:

from Kartik Sheth (Ext) to Everyone: 2:39 PM

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from Shouleh Nikzad (Ext) to Everyone: 2:41 PM

individual videos?

from Jessica Gaskin (Ext) to Everyone: 2:45 PM

Got ya!

from Terry Trevino (Ext) to Everyone: 2:51 PM

Volunteering now to do aything for that Grant!

from Grant Tremblay APAC member (Ext) to Everyone: 2:53 PM

ak! sorry, should've identified myself when speaking

from Jessica Gaskin (Ext) to Everyone: 2:54 PM

It helps that everyone is on camera now

from Shawn Domagal-goldman he/him (Ext) to Everyone: 3:19 PM

I can also potentially speak to the overlap here, if it helps.

from Shawn Domagal-goldman he/him (Ext) to Everyone: 3:21 PM

NExSS (the Nexus for Exoplanet System Science), is one of a set of Research Coordination Networks in the NASA Astrobiology Program. It is funded in part by APD, and it's science results are related to exoplanet missions.

from Jessica Gaskin (Ext) to Everyone: 3:22 PM

Thanks Shawn!

from Kartik Sheth (Ext) to Everyone: 3:26 PM

Can I addresss this point

from Kartik Sheth (Ext) to Everyone: 3:27 PM

Eric is going to address the thing I was going to talk about the GOFs at GSFC

from Kartik Sheth (Ext) to Everyone: 3:34 PM

JWST Users Group: https://www.stsci.edu/jwst/science-planning/user-committees/jwst-users-committee

from Grant Tremblay APAC member (Ext) to Everyone: 3:35 PM

Beth Biller is STUC chair (HST)

from Kartik Sheth (Ext) to Everyone: 3:35 PM

HST: https://www.stsci.edu/hst/about/space-telescope-users-committee

from Terry Trevino (Ext) to Everyone: 3:39 PM

Awesome work!

from Grant Tremblay APAC member (Ext) to Everyone: 3:40 PM

YAY JANE!!!!!

from Grant Tremblay APAC member (Ext) to Everyone: 3:40 PM

and THANK YOU JOHN!!!

from Ryan Hickox (Ext) to Everyone: 3:40 PM

Congrats and thanks!

from Marufa Bhuiyan (Ext) to Everyone: 3:40 PM

Thank you too. It's always fun to join NASA meetings speacoally this one Astrophysics Advisory Committee Meeting! See you again.

from Jennifer Wiseman (Ext) to Everyone: 3:40 PM

Thank you APAC!

from Jessica Gaskin (Ext) to Everyone: 3:40 PM

Thanks everyone for some great discussions!

from MaggieBeth Turcotte (Ext) to Everyone: 3:40 PM

Thank you, APAC!

from Grant Tremblay APAC member (Ext) to Everyone: 3:40 PM

yes thank you to all presenters, phenomenal talks

from Marufa Bhuiyan (Ext) to Everyone: 3:41 PM

bye-bye

from Dominic Benford (Int) to Everyone: 3:41 PM

Thank you everyone!