NASA Advisory Council
Astrophysics Advisory Committee

July 23-24, 2024

Hybrid Meeting

USRA/NASA Headquarters
Washington, D.C.

Dr. Kelley Holley-Bockelmann, Chair

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Dr. David Morris, Executive Secretary

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July 23, 2024

Introduction and Announcements

Dr. David Morris, Executive Secretary of the Astrophysics Advisory Committee (APAC), opened the meeting, took roll, made administrative remarks. Dr. Morris reminded members of conflict-of-interest (COI) matters, and identified those members who did have specific COIs. He introduced Dr. Grant Tremblay, standing in for the APAC Chair, Dr. Kelley Holley-Bockelmann. Dr. Tremblay said he was conflicted on the Chandra and Hubble Space Telescope, and said he would limit his participation in relevant discussions. Dr. Tremblay remarked on the budget difficulties facing NASA and the Astrophysics Division (APD), and noted it was important to remember what NASA accomplishes on a daily basis. Budget decisions are going to make some communities unhappy no matter what, and the hope is to give each other grace and respect. He observed that astronomers are good at sticking together, as they work over decades of mission time.

APD Update

Dr. Mark Clampin, APD Director, welcomed APAC members, and presented a status of the division. He noted no major changes in the organization. He reviewed APD's two major foci; Research and Analysis (R&A) and Flight Programs, in addition to cross-cutting and APD strategic mission offices.
Dr. Joe Smith is managing Flight Programs, including the development of the Roman Space Telescope, ensuring maintenance of cost and schedule parameters. Dr. Eric Smith is Associate Director of the R&A Program. APD's cross-cutting staff is headed by Chief Technologist, Dr. Mario Perez.

There are currently 15 operating missions in APD, with 17 missions in development, and a large R&A program, supporting 365 Principal Investigators (PIs). Missions include SmallSats/Cubesats, Sounding Rockets, and Balloons. APD runs the Balloon Program for the entirety of the Science Mission Directorate (SMD), including a number of Heliophysics missions. APD's Great Observatories (GO) are large, multi-$B class missions (e.g., Roman, Webb). There is also a new line thanks to the 2020 Decadal Survey (DS); these are Probe or medium-class missions capped at $1B. Explorers, or MIDEXEs are PI-led missions capped at $300M, and also include Missions of Opportunity (MoOs). Dr. Clampin noted that in the last round of competition, APD was unable to select a MoO, and will not be able to do so in 2025. Small research missions referred to as Pioneers, are capped at $20M. Research missions, such as Cubesats, Sounding Rockets, Balloons, and suborbital missions, are solicited through the APRA and SAT programs and have costs generally between a few $M and $10M. NASA contributions to international missions can be anywhere from $100M to $1B. Examples of international collaborations include Euclid, Laser Interferometer Space Antenna (LISA), and the Ultraviolet Transient Astronomy Satellite (ULTRASAT).

Dr. Clampin relayed recent instances of community recognition: Dr. Jane Rigby received the Medal of Freedom for her work on the James Webb Space Telescope (*JWST or Webb*) and Dr. Marcia Rieke was recognized for her work on NIRCam on JWST. Dr. David Charbonneau and Dr. Sara Seager won the 2024 Kavli prize in Astrophysics. The Chandra X-ray Observatory celebrates its 25th anniversary this year; key contributors to its success include Nobelist Dr. Riccardo Giacconi, who laid the foundation for Chandra.

In science highlights, Webb discovered the most distant known galaxy, formed 290 million years after the Big Bang (BB), and celebrated its second anniversary with a new image release. A new Program Manager (PM) for Webb, Dr. Mike Davis, will start on 11 August. Other highlights include the detection of star clusters in a gravitationally lensed system (460M years after BB). In addition, Super-Earth 55 Cancri e was found to have an atmosphere rich in CO or CO_2. The highest priority for APD at present is finishing the Nancy Grace Roman Telescope, which is making amazing progress. The Coronograph Instrument (CGI) was delivered on 19 May, and completed its initial round of testing in June. The Wide Field Instrument (WFI) completed environmental testing and is due to deliver in August. The performance of

the CGI meets requirements in both modes: Hybrid Lyot, and Shaped Pupil Coronagraph. Dr. Clampin praised the Jet Propulsion Laboratory (JPL) for successful delivery of CGI, as it is a particularly complex optical instrument. The telescope is expected to arrive at Goddard Space Flight Center (GSFC) in October.

The status of the Probes selection is embargoed at the moment for proposal review. APD is planning a downselect in the last quarter of 2024, and is moving forward as recommended by the Decadal Survey. The X-Ray Imaging and Spectroscopy Mission (XRISM), a NASA/JAXA partnership, launched in 2023, is also progressing. NASA/GSFC provided the microcalorimeter sensor, one of the first quantum sensors to be flown in space, representing a major technology breakthrough, and a very capable spectrograph for high-resolution x-ray spectroscopy. Cycle 1 observations will begin in August. The Euclid science survey began in February of this year, followed by public release of early data back in May. The ROSES call for the Euclid Guest Investigator (GI) program is now out.

The Spectro-Photometer for the History of the Universe, Epoch of Reionization and Ices Explorer (SPHEREx), a MIDEX mission, is pretty much fully assembled and is undergoing vacuum testing. Some anomalies have been identified and are being worked. The mission will undergo an Operations Readiness Review (ORR) in December 2024 (note that this date was originally reported as October during the July APAC meeting, but is revised in the minutes, here, to reflect a change in date that occurred after the meeting), with launch expected in February 2025. The Compton Spectrometer and Imager (COSI) mission is making good progress. The Key Decision Point C (KDP-C) milestone review was held on 16 April. COSI will fly on a Falcon 9 launch vehicle. The mission is currently focusing on completion of all 20 germanium detectors.

The Ultraviolet Explorer (UVEX), is due to launch in 2030. UVEX will take a synoptic survey of the entire sky at high resolution in the near- and far-ultraviolet spectrum. UVEX was selected because it had a great science rationale, and because it will also provide a large legacy database that will be of benefit to the whole community. Dr. Clampin likened the mission to the Transiting Exoplanet Survey Satellite (TESS), which was to exoplanets what UVEX can be to Time Domain science. For SMEX missions, APD is looking for more missions like the Imaging X-ray Polarimetry Explorer (IXPE), which opened up x-ray polarimetry with new technological capabilities.

LISA is targeted to launch in 2035. NASA is contributing the telescopes, lasers for interferometry, and a science center for LISA. The mission team is working closely with NASA/GSFC to prepare for KDP-B, and has appointed Dr. Mark Boynton as Program Manager (PACE, JWST). A Project Scientist has been selected as well.

The New Advanced Telescope for High-Energy Astrophysics (NewATHENA), scheduled for launch in 2037, is a Flagship led by the European Space Agency (ESA). NewATHENA is a large x-ray observatory which will investigate the hottest and most energetic phenomena in the universe. NASA plans to have a US ground science segment, and is contributing transition edge detectors and readout Superconducting Quantum Interference Devices (SQUIDs) for the X-ray Integral Field Unit (X-IFU) spectrometer. In addition, NASA is contributing a cryocooler, vibration isolation system, and ASIC readout circuit design for the Wide Field Imager (WFI).

In the Balloon program, super-pressure balloon production for the FY25 Wanaka Campaign began at the end of May. The Balloon program has been valuable for supporting Early Career (EC) scientists. The Sweden campaign supported a number of successful experiments, including the High-Energy Light Isotope eXperiment (HELIX), which met its science requirements after 6 days aloft. The main challenge to the Balloon program at present is the need to find alternative North American locations. The Balloon Working Group is working to augment current sites (Fort Sumner, e.g.).

Pioneers, SmallSats, Balloons, and International Space Station (ISS) payloads under development include Pandora (SmallSat), a Multiwavelength Characterization of Exoplanets and their Host Stars (launch in 2025) and PUEO (Balloon), a Long-duration Balloon-borne Instrument for Particle Astrophysics at the Highest Energies (launch in 2025). CubeSats launched and under development include BurstCube (launched in 2024), and SPARCS (launch in 2025).

Time Domain and Multimessenger Astronomy (TDAMM) is the second highest priority identified in the Decadal Survey. APD has established a TDAMM Science Interest Group (SIG), and three Science Analysis Groups (SAGs). ACROSS, a pilot initiative, is focused on situational awareness, observational awareness, and cross-mission follow-up decision support tools, as well as development of a TDAMM-focused Announcement of Opportunity (AO) for tools and science. NSF held a NOIRLab workshop, Windows on the Universe, focused on infrastructure and ground-space coordination, and released a second white paper in December 2023. NASA has established a General Coordinates Network investment in space communications infrastructure, to upgrade to modern, open-source, reliable, and secure alert distribution technologies, and Cloud deployment. APD is also looking at the Tracking and Data Relay Satellite System (TDRSS) flyout plan, to determine what the Space Communications Network (SCaN) is planning for commercial opportunities. NASA is going to have to ask some PIs to find their own space communications opportunities for downlinks, etc. This is a challenging issue for TDAMM astronomy, as well as for other NASA divisions. APD is preparing as much as possible with current assets.

APD is currently in Fiscal Year 2024 (FY24). Dr. Clampin pointed out that the FY24 Committee recommended $98B for the Hubble Space Telescope. In addition, the FY24 budget supports the new line of Pioneer-class missions, but will not support an accelerated cadence of Explorer missions; APD will concentrate on maintaining the current cadence. The Roman Telescope development budget is capped at $3.5B. APD has been directed to spend $187M on Webb, and up to $20M to continue the close-out of the Stratospheric Observatory for Infrared Astronomy (SOFIA). SOFIA's last grants will be completed by the end of this fiscal year. The aircraft is now in a museum, and at least 50% of its spare parts have been dispositioned. Dr. Clampin congratulated the team on accomplishing the close-out. The FY24 budget also provided Astrophysics Research a total of $290M, in good recognition of its importance. New Senate language directs that no less than $10M be spent on the Habitable Worlds Observatory, and to establish a project office at Goddard for technology development. Senate language also supported the Great Observatory Maturation Program (GOMAP) as recommended by the 2020 Decadal Survey.

Dr. Clampin noted that Webb is in prime operations, and that NASA has partnerships with Euclid and XRISM. APD is trying to make sure there is a balance between extended missions (EMs) and new missions. Many EMs are also x-ray missions. As APD gets to this stage of Roman, the division also has to start thinking about ground system support after launch. Roman will be NASA's first foray into the petabyte data regime, presenting a new paradigm in science. APD is working hard with IPAC and STScI to ensure preparations for this new paradigm. Another major priority for APD is maintaining international partnerships, such as LISA.

In response to numerous budget challenges, APD established an Operations Paradigm Change Review (OPCR) to determine what can be done for Hubble and Chandra. The usual vehicle, the Senior Review, was not used because of timing issues. NASA is seeking a more cost-effective way to operate these missions going forward. There is no easy answer. There will be a virtual Town Hall, probably in mid-September, to deal with OPCR feedback. The OPCR is complete and has produced findings, but not recommendations, thus no particular operational posture is being advocated.

The Hubble Space Telescope (HST; Hubble) has transitioned to One Gyro Science (OGS) operational mode, since Gyro 3 grew to be increasingly problematic. The telescope has larger solar exclusion angles

as a result, so it takes longer to acquire science. There will be 500 fewer science orbits per year in this mode. The Field of Regard at any one time will be reduced from 82% to 50%. Asked how many total orbits are planned, Dr. Clampin took an action to provide a number later in the meeting. In response to this action, the APD later noted that in three gyro science mode there were about 84 primary science orbits per week (4368 per year) while in one gyro science more the HST expects about 74 primary science orbits per week (3848 per year). Primary science orbits include external TAC awarded Guest Observer observations, Director's Discretionary time, and necessary external calibration observations.

The Habitable Worlds Observatory is the next Flagship mission concept recommended by Astro2020. It will be the first telescope designed to search for signs of life on other planets. The big picture strategy is based on a number of parameters: build to schedule; evolve the technology by building on current technology; TRL-9 maturity; next-generation rockets, with larger fairings, to accommodate larger telescope aperture sizes; enable servicing at L2. In addition, the plan is to build with lots of margin everywhere: scientific, technical and programmatic. First and foremost, the goal for HWO is to reduce risk by maturing the technologies prior to formulation. A UV Science and Instrumentation Workshop was held in May at JPL, demonstrating that this community is very excited about HWO. There were 180 participants, focused on subjects such as transformative UV and optical astrophysics. The HWO office will open on 1 August at GSFC, and Science, Joint and Community Working Groups will continue with as-planned milestones through the end of year. APD expects to stand up a Science Definition Team (SDT) once the HWO office is up and running. The Project Office will be staffed by "Project Architect," Dr. Lee Feinberg, and a Project Scientist and PM will soon be appointed.

In response to some questions, Dr. Clampin made the point NASA is treating this as a real project, but it is not in the process of designing a telescope. HWO will enter "pre-pre-phase A" on 1 August. Asked if there had been coordination with outside philanthropic programs on HWO, Dr. Clampin said there have been some informal discussions about engaging philanthropists. He added that in 2017, former APD Director, Dr. Paul Hertz, created programs to support HWO technologies [Ultra-CT (ultra-stable telescope), TechMAST, and STABLE], which will contribute greatly to technology planning. STABLE differs from Ultra-CT in that Northrup Grumman is working on deploying baffles. These investments include academia, NASA centers and commercial entities. Asked if there were opportunities for university research programs, Dr. Clampin said that next year the HWO Project Office will start to consider academic contributions.

On the subject of emerging technology for Astrophysics missions, Dr. Clampin felt it was time to engage with the community through a dedicated workshop, in particular to look at astrophotonics, advances in manufacturing and nanotechnology, composite materials and metamaterials (e.g. black coatings for stray light baffling), quantum technologies, metrology, atom interferometry for gravity wave detection, and sensors technologies such as Transition Edge Sensors (TESs), Microwave Kinetic Inductance Detectors (MKIDs), and Nanowire Single Photon Detectors (NSPDs).

The division is developing the Fornax initiative, a Cloud-based system that brings data, open source software, and computing to enable researchers to focus on the science. Dr. Clampin noted that APD is developing Open Science Data Management Plan templates for mission proposals, and is collaborating with SMD and the community (AAS and ADS) to do such things as link DOIs for each Open Science component (proposals, data, software and publications). NASA will hold a Town Hall on the subject at the next AAS meeting.

Under the direction of SCaN, the Communications Services Project (CSP) is collaborating with industry to offer commercial space relay communication services for NASA missions in

near Earth-orbit. The NASA website has more information on industry capabilities. Out of 520 applicants, NASA Hubble Fellowship Program (NHFP) recently announced 24 new fellows.

Dr. Clampin briefly touched on APAC Recommendations from March 2024. In response to a recommendation to review the Explorers Program, APD has initiated discussion with the Deputy Associate Administrator for Research. This subject has also been a subject of a recent SMD retreat, and results are in work. In response to APAC recommendations, APD reviewed the Terms of Reference and approved two Science Analysis Groups: Technosignatures and Exoplanet Reflectance Spectroscopy for the Habitable Worlds Observatory.

An APAC member commented that in order to make room for a new Flagship mission, old ones must be ramped down. Many Flagship budgets are Congressionally mandated. Where does this money go when a Flagship goes away? Dr. Clampin said the funding gets directed to other items in the APD portfolio, to address Decadal Survey priorities, for example. There are many financial challenges at present: inflation, costs of hardware, and staying healthy in a flat budget on top of Decadal Survey recommendations. In essence, the money is "mobile," and can be used to plan a science budget in the outyears, e.g.
In response to an expression of concern about technology developing while there is a gap in science training, Dr. Clampin said he was aware of this gap, and was trying to avoid raiding R&A. Technology is needed for every new Astrophysics mission, and not much had been spent on it in the prior year. An APAC member commented that there is much opportunity for scientists with historical data and smaller-scale science data products. Another participant commented that funding is needed to support the people who are analyzing the data; another noted that ADAP does in fact include data from all NASA missions. Dr. Shirley Ho asked if there is a program to support Cloud-based access to data. Dr. Clampin said that the expectation is that proposers will be asked to consider the cost of access to the Cloud, to get the best possible deal. APD is trying to ensure access. Dr. Linda Sparke noted that the Earth Science Division (ESD) has an Earth Data login, whereby users get a certain amount for free. If users want more, they need to make special effort. NASA is trying to ensure some amount of free downloads for citizens, and is hoping that Cloud costs will come down to the point for NASA to allow "normal use." Asked about the budget numbers for technology development, Dr. Clampin said the budget has been flat, but through inflation there has been basically a $20M decrease from 2023 to 2024. Dr. Shardha Jogee asked about next steps after the OPCR: Where would the high level discussions happen next? Dr. Clampin said that some numbers are embargoed due to the current FY25 planning process. APD is using the findings to guide decisions. The plan is to make these decisions public by mid-December via virtual Astrophysics Town Halls. Dr. Clampin emphasized that there is no intent to shut down the telescopes; the OPCR was conducted to find cheaper ways to operate them. Every division is facing the same problem. There is no earmark from Congress for Chandra. Dr. Tremblay commented that APD has been losing billions in buying power since 2020, through inflation. Dr. Clampin reminded APAC that APD hasn't lost any large missions through budget pressure, and does not intend to let that happen now.

OPCR

Dr. Rob Kennicutt presented the results of the OPCR, on behalf of Dr. John Mather, OPCR Chair. He noted that the OPCR had European representation, and that all members were astronomers. The OPCR was held to address the effects of a 20% cut to APD over the last couple of years. Chandra and HST were asked to provide four scenarios as to how they could continue to operate under these conditions. The OPCR was not a Senior Review, rather it was a fast-track exercise to determine how to continue operations. Evaluation criteria were: scientific merit; relevance and responsiveness; and technical capability, management and science productivity, given the costs. Each project submitted charts, and each submission followed a format (text and budgets) and certain categories of costs that could not be reduced. The OPCR was accomplished between 20 April and 20 May. Dr. Kennicutt noted that the teams were terrific, and each submission was written in depth. Despite much turbulence and sensitivity, everything was professionally carried out.

Panel background value statement:

- Maximize scientific productivity and ability to make groundbreaking discoveries
- Take reliable scientifically useful data from these observatories and make sure it is appropriately archived for future use, to enable scientific discoveries.
- Maintain training and expertise in X-ray/UV/optical astronomy, in order to pave the way for future missions such as HWO and Lynx.
- Nurture community of young users and contribute to equity in the STEM pipeline.
- Maintain US leadership position in astrophysics

Summary of findings for HST and Chandra:

- OPCR found that both missions are Great Observatories with huge observing communities, and both are sources of frequent scientific breakthroughs, and increasing numbers of publications
- Both received top marks in Senior Reviews for high return on the dollar
- Annual operating costs are a few percent of capital cost, with guaranteed return on investment
- Both are unique and currently irreplaceable
- Both have synergy with JWST and TDAMM
- Both are in good operational health and oversubscribed
- Both are capable of running well into the next decade
- Both have approved end-of-mission plans
- GO and Archive program funding ensures prompt analysis and publication, and support for future scientific leaders
- Archives are used worldwide, including at small institutions with diverse student bodies
- Operations are optimized and streamlined
- Operation costs are mostly staff; cuts would result in reduction in force (RIFs)
- Ending these missions would be premature and at great cost to science and the community

HST

HST has less of a budget challenge to remain in-guide, 15-20% cut. HST explored reductions in 3 areas: option A sees the most savings from reductions in GO funding; option B eliminates some instrument modes; Option C reduces mission operations coupled with a lesser reduction in GO funding than Option A; Option D avoids reduced capabilities and maintains most GO funding, but would require overguide funding numbers.

OPCR findings

Option A has an in-guide budget, removal of overlap with JWST, and continuation of mission operations, as well as continuation of most of HST's instrument functionality, seen as a strength. Most of the cost savings in this option would come from reduced levels of GO funding.

Option B has a minimal configuration (critical only). While significant parallel science is lost in all options, Option B drops the least used instrument modes, essentially retaining WFC3/UVIS, STIS/NUV; STIS/FUV, and COS/FUV. Dr. Kennicutt felt that Option B was sound, as it retains 75% of HST utilization, and includes GO funding at a fraction of current levels. OPCR sees its weaknesses as loss of high-level science products, and elimination of instrument modes that likely can't be restored.

Option C features an in-guide budget, configuration UVO, and increased risk in mission operations (no preparation for failures); the GO funding level is similar to Option B. OPCR sees its strengths as

continuation of most instrumentation, and inclusion of GO funding. Weaknesses are that it is more risky due to loss of flight operations staff in later years, and loss of support for high-level science products.

Option D features over-guide funding, UVO configuration, while mission operations and GO funding continue. Strengths are continuation of most instrument functionality, with only redundant and non-unique functions dropped; and maintenance of GO funding at current levels. Weakness is the need to obtain agreements for funding, and loss of support for high-level science products.

Any of Options A, B, or C taken alone could meet the in-guide budget targets. The OPCR did not reach a clear consensus, however, on any one of the options being clearly preferable over the others, and the ultimate decision should be made after further discussions with HQ. The committee did note, however, that an optimal solution might involve a combination of reduced cuts in two or more of the three options that were presented.

Chandra

Chandra's task was much more challenging than that of HST, as it faces much larger cuts in FY25 PBR.
Option I: close the mission (in-guide)

The remaining three options are all over-guide:
Option II- "Chandra TSL", or TDAMM/Synergy/Legacy program elimination of regular GO observing and reduced user support, with loss of 65 FTEs, loss of GO and replaced by TDAMM and JWST synergy Legacy program, requiring increases in FY26-28
Option III- "TSL+" , or Option II with increased levels of user support
Option IV- full capability mission

OPCR findings

- Option I meets the requested budget profile, but its weaknesses would eliminate a fully functioning GO
- Loss of scientific discoveries at the beginning of TDAMM and JWST synergy
- Loss of NASA prestige and US leadership
- Irreversible
- Requires rapid adoption

Option II findings

- Minimal but impressive science capability, most widely used instrument is maintained
- Costs $20M less/year than FY24 (30-35% reduction)
- Includes Legacy programs that are proven to be cost-effective
- No funding for new GOs
- Only 50% of observer time would be used
- Instruments that are turned off are lost forever
- Does not meet budget guidelines in years 2 and 3

Option III

- Includes GO funding related to main themes
- Continues operations, including funds for training Early Career researchers
- More expensive than Option II

Option IV

Makes modest cuts through attrition, and small savings, continue to operate until next Senior Review Restores the nominal observing efficiency, permits double the on-sky exposure, doubling the scientific impact of the observatory. Restores the GO program, maximizes discovery space and allows the science program to continue.

Dr. Kennicutt said the committee felt that Option II retained most of the value of the mission, and enabled some savings to NASA. However, no matter what happens, it is obvious that there will have to be big trade-offs. Dr. Kennicutt emphasized the point that if NASA decides to cut GOs, it should not disenfranchise one wavelength community over another.

OPCR Discussion

Dr. Morris identified conflicted members, who recused themselves, and established ground rules for the discussion. Dr. Clampin clarified some HST budget numbers. Chair Dr. Holley-Bockelmann commented that APAC had not been given any prior OPCR information, and suspected that decisions had already been made, which makes it difficult for the APAC to be useful. Dr. Kennicutt noted that the budget process is still a fluid situation at both NASA and on the Hill, and that the landscape is still likely to change. He felt that the OPCR's findings on strengths and weaknesses could carry through the politics. Asked what fraction of the total were the GO cuts, Dr. Kennicutt said the numbers were in the 20s of millions, and that the OPCR had been asked to keep slides qualitative. Dr. Clampin said the numbers were typically $25M. Asked how the decisions about HST and Chandra would be made, Dr. Clampin said that through the FY25 and FY26 PPBE process, APD will find a solution based on the numbers given to OPCR from the missions. He cautioned that the PBR is a recommendation, and that the actual budget comes from the Hill. However, NASA can't wait for an appropriations bill, and is obligated to work on the budget throughout the year. Contrary to rumors, he added that there have been discussions at the respective NASA Centers, but no RIFs are in progress. Dr. Holley-Bockelmann said that the APAC is concerned about premature actions, and the loss of a work force vital to astronomy. As with SOFIA, the community had advocated heavily for the work force. The OPCR process is such a big contrast to that which surrounded SOFIA. Dr. Clampin agreed that the original SOFIA rampdown was conservative, but that the current budget cuts are much steeper, and APD does not have the room to move money around. Serious steps are required to face this budget challenge. Dr. Jogee asked, with respect to the plan ahead for Chandra, how there is anything other than a closeout. Dr. Clampin noted that there is still money in FY24 for Chandra, and money is being spent on it. However, in contrast to HST, there is no funding specified by Congress to be spent on Chandra. Since APD hasn't been given any language, it is using the OPCR review to inform decisions about Chandra.

Public Comment Period

-Asked if there were APD plans beyond Chandra for x-ray missions, Dr. Clampin said that APD does not want to shut down Chandra. NASA still has a broad swath of missions supporting x-ray astronomy, and a healthy R&A program.

- The Hubble User Committee provided a comment on HST's unique capabilities.
- Asked if there would be a larger review pursuant to budget pressures, such as from the National Academies, Dr. Clampin said that planning is already in progress for the mid-Decadal review, and that a larger NAS review would require everything to be put on hold for one to two years. As the Division is dealing with significant reductions now, hard decisions must be made and HST and Chandra are not the only programs being affected.
- Asked that, if decisions had already been made, why do the OPCR, Dr. Clampin replied that APD has done what was requested, to deal with the budget.

-Asked if there was a plan for funding archival data, Dr. Clampin noted that Chandra is already in ROSES for archival proposals, and planning is under way for HST.

-Dr. Dave Pooley, current chair of the Chandra User Committee, commented that there is concern in the community that the PBR had contained much inaccurate information about Chandra. He thanked the OPCR, and added that the problem is one of abandonment of established procedures. A competent review is necessary. Chandra produces top tier science for the funding. Nine members of Congress signed a letter to the NASA Administrator to support Chandra. Funding for Chandra should not be pulled until the OPCR findings are properly dealt with, and the misleading statements in the PBR about Chandra should be publicly corrected.
-Dr. Harry Teplitz, Chair of the Hubble User Committee, thanked the OPCR, and said the Committee feels it is important to recognize the unique successes of both missions. HST has unique capabilities and is a pathfinder for HWO. The Committee is concerned that major changes may be irreversible, and implemented on a rapid timescale without sufficient community input. It would be preferable that budgets can be managed without significant impact to operations and sudden changes in funding to the GO community. Dr. Clampin said he would take the comments under advisement.
-Asked about the impact on the ROSES Astrophysics Program, Dr. Clampin said that APD has kept ROSES flat, and selection rates have been good. Any new work on missions such as Roman would likely be done under ROSES.

Dr. Clampin remarked on the healthy exchange of ideas, and assured APAC that he was receptive to their thoughts on the OPCR findings.

2025 Senior Review

Dr. Linda Sparke reported on plans for the 2025 Senior Review, a regular, independent, comparative review of missions in extended operations. The Senior Review is conducted in a slightly different way for each cycle. In the 2025 review, all missions will be reviewed by a single panel. The review will consider HST, Chandra, X-ray Multi-Mirror Mission (XMM; ESA), Swift, Fermi, Nuclear Spectroscopic Telescope Array (NuSTAR), TESS, and IXPE. The Neutron Star Interior Composition Explorer (NICER) will not be included, as it is about to undergo some repairs. Dr. Sparke reviewed the timeline and the draft Call for Proposals, remarking that the deadline for comments on the draft Call would be due on July 29, so APAC should give their comments as soon as possible, so that the APD can give missions timely guidance. This is a particularly important year, and the results of the 2025 Senior Review can help APD justify over-guide requests. The schedule calls for the proposals to be in by December, with the final reports available before the March 2025 PPBE.

The 2025 Senior Review panel will grade each mission on three review criteria, and will separately grade the proposed mission over-guides. The three review criteria are: scientific merit (Criterion A, 50%), relevance and responsiveness (Criterion B, 25%), and technical capability and cost reasonableness (Criterion C, 25%). Each project must define a set of Prioritized Mission Objectives (PMOs) for FY26-28, with possible extension to FY29-30.

NASA will use the Senior Review findings to provide programmatic direction to the missions and projects for FY26-28, and issue initial funding guidelines for FY29-30, and to understand where any additional funding that becomes available could be most effectively applied. The Call for Proposals and other information on the 2025 Senior Review can be found at [[https://science.nasa.gov/astrophysics/resources/documents/2025-senior-review-of-operating-missions/]].

Dr. Sparke displayed the NASA appropriated budget in real year dollars, showing that in FY 2024 NASA's budget had decreased in real-year dollars for the first time in a decade. In FY 2012 and 2013, however, Human Space Flight was much more heavily affected than science. This time, Science is less protected.

An APAC member commented that the Senior Review process will prove a challenging impact on the teams that just went through OPCRs. Dr. Sparke said that the Senior Review is required, as Congress mandates this. The 2025 Senior Review will consider changes since the OPCR, such as the HST transition to One Gyro Operations. APD has to look across the whole portfolio of missions to be prepared for challenges coming in the future. Dr. Clampin added that APD was also trying to re-engage the Senior Review with the budget cycle, as the Review results are critical input into the PPBE. He said he understood that it puts pressure on the teams, but this information is necessary to inform the next budget cycle. APD needs to have budget scenarios that make sense. Dr. Rebecca Oppenheimer said she had been on review panels in the past, and was irritated that Chandra and HST were separate. She thought the single panel approach was an improvement. Asked if the Senior Review was just making more work for everyone, Dr. Sparke said that if NASA were to receive extra funds, the Review would help determine how to best use them. The Senior Review will give not only an overall rating for the mission, but also rates the science impact of marginal gains and losses for each mission. Dr. Tremblay asked if the Senior Review panel would be a subcommittee of the APAC. Dr. Sparke said that the review would be a contracted task, not a subcommittee of the APAC as it had been for the two most recent Astrophysics Senior Reviews. The APAC will be briefed on the review outcome, though the missions will be informed of the findings first. Dr. Tremblay said it was possible that NASA might get an authorization bill right after the election. Dr. Sparke said an authorization bill might constrain what can be done with the findings. Dr. Clampin said he would ask the Legislative Affairs Office to provide a response to these concerns.

Dr. Steven Ehlert asked, if Headquarters had all the information about mission closeout costs that it needs. Dr. Sparke said that her guess would be No. Dr. Tremblay said, for the record, that a number of projects have reached out expressing frustration at the timelines being moved up. NASA is putting the call out four months before the proposals are due. Asked if the Senior Review could be less onerous, Dr. Oppenheimer commented that the Senior Reviews are written into the authorization acts. Dr. Sparke noted that the Senior Review focuses on the most important science, which can help to identify the real loss of science when budgets must be cut. With Chandra, she said she had been hearing much community comment on capability, but little about the actual science that might be lost. APD needs this latter information to properly inform and defend its budget requests.

APD Tech Development

Dr. Dominic Benford gave a status of APD's technology investments, using a metric called "infusion status," which indicates whether a technology has gotten infused into missions. APD has identified over 100 technologies over the last 15 years that have made their way into various missions, space, rockets, Balloon Programs, etc. Most technologies are selected through Astrophysics Research and Analysis (APRA) and Strategic Astrophysics Technology (SAT) proposals. There has been a faint trend of declining proposal selection rate, due to inflation and maybe people trying to expand the scope of investigations. Actual investments in APRA (technology, Lab Astro, Suborbital, CubeSats), Pioneers, SAT, RTF, ISFM and Mirrors, which together constitute technology development and small missions, have seen 6% annual real growth. Roughly half the funding goes to missions, and the other to technology development.

Orbital projects have not seen many launches to date (BurstCube is the latest). There are three or four Orbital launches coming this year, and a suite of Pioneer launches that will occur toward the end of the decade. Dr. Benford said that APD has some current policy concerns about how it should prioritize the balance of investments into pure technology development, mission technology development, and Suborbital/small missions, as well the balance of Suborbital and small missions for supporting EC researchers vs. doing science. There is pressure mounting for bigger projects vs. more projects. APD is spending the same amount of money, but is not getting the Balloon launch rate it wants. Given the budget at present, things take longer. Asked if APD had looked at stumbling blocks, Dr. Benford said that APD

runs regular workshops on Balloons, and also supports a Balloon working group, to answer these sorts of questions. It is difficult to mandate Lessons Learned. There is a private company that makes gondolas, but NASA doesn't want to force people into standardized platforms. Flights are decreasing, but the missions have been very successful and scientifically viable. A participant commented that there has been conversation about formalized CubeSat platforms which might be a useful approach in the Balloon and Sounding Rocket program. Dr. Benford noted that there is a CubeSat/SmallSat community that does this, and they are reliant on a substantial commercial base. This helps leverage standardization. Costs have gone up here, however. Buses are more expensive than they used to be. There is a possibility that APD could consider a Planetary R&A technology development model, such as PICASSO and MATISSE. However, CubeSat costs are going up because vendor prices are going up, and projects are delayed while on-orbit operations continue. This can't be sustained at $5M/year anymore. APRA SubOrbital is important for EC training; if the selection rate is decreased, there will be fewer opportunities for EC researchers. What to do? Select fewer than one per year, lower the cap, reallocate funds?

Strategic Technology Flight Demonstration
Dr. Benford introduced the possibility of using part of the SAT technology maturation program to allow flight projects, in the form of CubeSat class ($10M) proposals as a pilot to try out flight technology maturation concepts. Constant funding means displacing other SAT selections; if the cap is set at $10M, it would displace four SAT projects. Is it beneficial to offer this, and let peer review make the selection? It could be a separate category in SAT, but it would still have overarching SAT requirements in terms of TRL. Asked if APD could partner with the Space Technology Mission Directorate (STMD) to pay part of those costs, Dr. Benford said that STMD is devoted to developing cross-cutting technologies for the entire SMD. A participant commented that NASA Wallops does Sounding Rocket technology demonstrations, and could perhaps do a similar thing for science instruments. It is not a high-cost endeavor. Dr. Benford said that SAT is focused on strategic missions, and has allowed for things like Probes in the past. Perhaps it could consider Explorer technologies. A CubeSat could be used for technology maturation, such as the CubeSat payload, CANDLE, which is tied scientifically to the Roman telescope, with the need for absolute spectrophotometry as a motivator.

Dr. Benford cautioned that budget is a zero-sum game for SAT. Dr. Clampin encouraged the APAC to get a briefing from STMD to hear their take on technology investment balance. Dr. Benford noted that Sounding Rockets, while a small part of the portfolio, has been used to mature microshutter technology, paving the way for next-generation spectrographs. Getting to TRL 6 means testing in relevant environments. A participant commented that APD needs to be more cognizant of what is available, market-wise, in CubeSats. Dr. Clampin said that while CubeSats are great on the shelf, they run into problems when integrating with science payloads, for example. Nonstandard implementation becomes complicated. Dr. Benford said that the majority of these missions are UV. A participant commented that as launch costs drop, one could be creative about getting more science into CubeSats. Cubesats to Pioneers is a continuum, and spans SmallSat capabilities. Dr. Tremblay said, for the record, that he had received many emails about cuts in APRA, and reminded the community that these are survival budgets. Dr. Benford noted that APRA/SAT tended to make selections that are all or none, and does not usually reduce budgets below that proposed. There have been some mission contributions to technology development, such as some from SPHEREx and Roman CGI. In the future, there will be a Habitable Worlds budget in the AP Technology Development budget. SAT is developed by individual proposers, and not directed by missions.

<u>Post-Time-Domain And MultiMessenger Astrophysics Communications Science Analysis Group (Post-TDAMM Comms SAG)</u>
Dr. Jamie Kennea briefed the APAC on the results of the SAG, first noting that rapidly time-variable and transient phenomena motivate the most stringent requirements on communications. The SAG was established by open community call (~30 participants), met monthly from July 2023 to March 2024 to

discuss each topic defined in the terms of reference (TOR). The SAG compiled a report with case studies and findings, to enable the APAC to make recommendations to NASA regarding the communications needs for TDAMM. Current NASA space communication capability is severely strained. NASA's legacy satellite communications system, TDRS, is being phased out and will not be replaced, thus future missions cannot rely on TDRS. While ground networks are bringing in some commercial capabilities, the Deep Space Network (DSN) is still very oversubscribed.

SCaN's Communications Services Project (CSP) is examining other future capabilities, such as increased use of commercial ground services, Laser Communication, and Lunar Relay. Within the context of NASA's entire communications infrastructure, The SAG focused on science topics defined by the 2022 NASA-NSF TDAMM Workshop White Paper. The SAG broadly categorized TDAMM-driven communications capabilities: continuous contact, demand access, low-latency data downlinking, and high-latency downlinking. A broad range of communications capabilities are needed at both predictable and unpredictable times. While existing NASA resources can meet these needs, they do not necessarily provide adequate flexibility, availability, and cost effectiveness. Upcoming replacement commercial services should improve upon current capabilities and maximize the science potential of NASA's future fleet. Dr. Kennea noted that many CSP solutions will require buying a custom terminal.

SAG Findings

Non-LEO orbits offer advantages to TDAMM missions:

Finding 1: Developing services to provide high-bandwidth, low-latency communications to non-LEO orbits is essential to enable future TDAMM missions.
Finding 2: Investment in developing new technologies that can provide spacecraft initiated demand access service or continuous communication links to non-LEO orbits is essential to enable future TDAMM missions

Bandwidth latency and coverage limit TDAMM ConOps

Finding 3: To support TDAMM Science, future communications solutions should look to ensure that low latency, high bandwidth and high coverage is available for all missions profiles.
Finding 4: The flexibility of TDRS has enabled TDAMM science, therefore access to similar solutions with commercial services in the future will be crucial.
Finding 5: Due to the limitations of onboard computing, some missions require rapid or high cadence downlinks of large datasets to detect and characterize transients - a function that is not currently possible.

Availability and Scheduling Flexibility are needed to enable TDAMM Observations

Finding 6: High availability of communication networks on short notice is essential for TDAMM missions to rapidly schedule communications assets to both respond to target of opportunity (ToOs) follow-up observations and prioritize downlinking of data around events of interest.
Finding 7: The use of efficient modern commercial scheduling interfaces (e.g. APIs) will enable TDAMM observations, and are more efficient than existing SCaN interfaces. APIs provide a real-time view of availability and eliminate back and forward interactions with human schedulers.

High Comms Cost Disadvantages TDAMM Proposals

Finding 8: In order to ensure that reliable and timely cost estimation by proposal teams is possible, teams need easy access to up-to-date documentation or tools to allow an accurate self-assessment of projected communications costs.

Finding 9: Pursuing direct relationships with commercial communications providers allows proposal teams to realize potential cost savings.
Finding 10: Removing communications costs from PI Managed Mission Costs would ensure TDAMM missions are not disadvantaged compared to other missions with less burdensome communications requirements, and ensure communications needs are scientifically motivated, rather than cost-driven.

A participant asked if NASA has considered a dedicated ground system that supports NASA in general, and added that while commercial sources reduce flexibility, there may come a point where this may become more beneficial. Findings 8-10 look more like a short-term solution. Dr. Kennea said that he had been seeing a lot of commercial ground stations, and that a dedicated system may suffer from congestion. In addition, NASA has been using NASA-built for decades; this has been proven costly to maintain.

Lack of Transition planning and AO consistency threatens future TDAMM capabilities

Finding 11: A smooth transition between communications services in the future ensures that AOs do not disadvantage missions whose science case depends on a service which is in transition.
Finding 12: Consistent communications requirements and costing across all NASA SMD AOs would ensure more accurate proposal development and evaluation.
Finding 13: Access to multiple providers through a common interface has potential to provide affordability and long-term stability to missions via bulk investment by SCaN.

SAG Conclusions

- Commercial providers have great potential to enable TDAMM missions in Earth orbit, if implemented correctly (e.g. allow GSaaS scheduling APIs, transition planning and affordability).
- Non-LEO orbit solutions, which lack commercial development, provide an opportunity for NASA to invest in the future.
- Removing comms costs from AOs would ensure TDAMM Missions can compete on a level playing field with other mission types.

<u>SCaN Comms, Commercial Space Relay Transition and CSP</u>
Mr. Greg Heckler, and Dr. Peter Schemmel co-presented an overview of SCaN's commercial space relay transition and the Communications Services Project (CSP). Recently appointed AA, Mr. Kevin Coggins, is enabling SCaN to engage as one team, with one mission, and one network, using the watchwords: Execute, Evolve, Empower. SCaN recognizes that TDAMM is not just about LEO, but also about Lagrange Points and lunar locations. SCaN is being careful to communicate that by the 2030s/2040s, TDRS will not be available to meet all mission needs. Over three generations of satellites have been launched for TDRS, the last launch occurring in 2017. The network has been a workhorse for the Agency for 40 years, serving mostly Shuttle and ISS, but also special use cases. In 2020, NASA began to pivot its LEO missions to commercial space relay services. While NASA has used commercial services for many years, Commercial Earth Relay is new. NASA considers the TDRS fly-out as a real opportunity for breakthrough.

SCaN is focused on capitalizing on larger market trends on supply side. Mr. Heckler noted that commercial SATCOM capacity is anticipated to increase approximately 20-fold in the next decade. The global SATCOM market was worth $77B in 2022, and is expected to grow at a rate of 9.7% from 2023 to 2030. Furthermore, the entry of first-generation LEO mega-constellations has opened greater business-to-business, government and consumer markets. Satellite direct to cellular is also accelerating the integration of satellite and terrestrial networks. Non-Terrestrial Networking (NTN) presents an opportunity for NASA to capitalize on a market with a massive number of mobile users with similar interests. NASA's intent is to unlock next- generation technology and services through CSP.

Dr. Schemmel, Project Manager for CSP, reported that NASA has awarded $278.5M to 6 companies: Inmarsat, Amazon Project Kuiper, SpaceX, SES, Telesat, and Viasat. This is truly a partnership, with a total estimated investment is about $1.5B. These companies are about halfway through their activities, and preparing for flight demonstrations in 2025-27. Projected services from CSP's funded Space Act Agreements will serve as demonstration of the whole ecosystem (including NOAA, NSF, and the Department of Defense) with end-to-end services to meet multiple NASA mission use cases. Commercial offerings could have significant benefits for Astrophysics, by providing massive interconnected networks that bring data in near-real-time to multitudes of location. This could ensure instant global alerts about a short-lived astronomical event detected by an on-orbit spacecraft, enabling rapid-response tasking of assets worldwide.

CSP will deliver services by 2031, and is currently developing service requirements for a service solicitation, using an IDIQ contract. A verification and validation campaign will be conducted in the latter 2020s. More information about the transition process will be coming out in the next few months, and SCaN will be reaching out to the community soon to get feedback on service requirements. Website: https://www.nasa.gov/communications-services-project/

Discussion

APAC discussed Finding 10 of the post-TDAMM Comms SAG, in that some AOs that don't include the communications part, raising the question of how communications costs can be covered by missions. Dr. Kennea said that while missions have benefited greatly, historically, from not worrying about communications costs, this will not be the case with commercial services. NASA wants to make sure it understand overall costs and how they evolve, but also wants to be able to take the costs out of the AO so that missions can concentrate on the science. Mr. Heckler said that the hope is that being one of many customers will help to reduce costs. Right now SCaN is a budgeted resource for the Agency, and it is centrally funded. In the operations phase, SCaN is not asking for funds. But this is not a good economic incentive. Currently, there is not enough to go around, but commercial presents an opportunity to change for the better. In response to a question about customer use cases, Mr. Heckler said that NASA asked commercial to meet at least one use case, but also to try to identify new drivers; the science needs near-Earth relay in the 2030s and beyond. NASA saw this as an opportunity to define new drivers, and have built this into the CSP life cycle.

Dr. Holley-Bockelmann commented that Findings 9 and 10 seem opposed to one another, and that Finding 9 also seems to set up inequities between teams. Dr. Kennea said that he understood that Finding 10 is a big ask. Dr. Jogee noted that there has been a conversation about SpaceX and its poor management track record, issues of transparency, political considerations, and the creation of a potential monopoly. Is there a vetting process that takes these issues into account? Dr. Schemmel said that all the demonstration activities have been under Space Act Agreements, followed by a competition for services. Ultimately the competition will be open to industry, and any of those concerns will be addressed by FAR guidelines, and any selectees will go through a V&V process. The supply chain will be assessed regularly, and NASA will also perform annual reviews of commercial readiness. Dr. Clampin asked if a selection of optical communications service would mean that proposals and missions in development would have to use it. Dr. Schemmel said that NASA is looking for a portfolio of companies that will serve all communications needs, and is working to identify those "bubble missions" that fall in the gap between TDRS and Commercial, on a case by case basis. Mr. Heckler said that SCaN will be able to specify what will be available to participants in the AO, during the "bubble mission" phase, depending on mission concepts.

APAC briefly discussed the oversubscription of DSN and its implications for both Roman and the Artemis program. A case study has been done for Roman, which is planning a White Sands dish upgrade

for support. There are other solutions, but they are very expensive. Mr. Heckler noted that for cis-lunar, infrastructure is being put in place (LEGS, e.g.), but right now DSN is being driven by human space flight. There are some unique challenges with Artemis, and NASA is exploring all options: DSN, build your own, and commercial. SCaN's plan for DSN is an aperture expansion project, which ends in the late 2020s. Meanwhile, NASA is architecting for the right solution, like ground-based phased arrays. The more SCaN can understand customer needs, the better. Asked if SMD has a plan yet for DSN and Artemis, Dr. Clampin said there is an "ongoing handshake" between SMD and SCaN, is being worked specifically at present.

Wrap-up

Asked how much time the mission teams usually have to prepare for the Senior Review, Dr. Sparke said the Call for Proposals is normally issued 3 months before those proposals are due. Dr. Tremblay asked if NASA deliverables to LISA were being run through the usual NPR 7120.5 practices. Dr. Clampin said that the LISA program will be managed by the Explorer Office, in a manner similar to the usual international partnerships, with parallel review schedules. When something slips, or requirements change, the teams meet the issue in *ad hoc* fashion. A participant voiced a thought about tech investments vs. small missions and what the optimal ratio might be, and how those statistics might reflect the health of the community. Dr. Benford said that the ratio represents what the community proposes. A participant commented that there are comparisons to be made in how this is done in other divisions, and that APAC should weigh in on this. Dr. Oppenheimer noted an inherent wavelength bias in missions. A participant noted that the other question is whether the entire community is being supported across all wavelengths, given the difficult budget situation. One would want to start from the science questions, ideally. Another participant commented that while the Decadal Survey is great, there are other groups that are smaller and undervoiced, and not fully represented in the Survey. There is no gamma ray Flagship mission, for instance. Dr. Jogee was excited to hear about partnering with academia and the high tech sector in ML/AI. Resources are in high tech right now, and human capital is in AI. She said she was seeing an increase in shared academia/high tech faculty. Where are the other federal agencies here? NSF has been very active in this area, but NASA does not seem to be prominently involved in this space. Dr. Clampin said that much of the APD already uses ML/AI. He suggested reformulating the question for Julie McEnery for the next day's briefing. NASA is talking with NSF about potential collaborations, and there may be a space here for robotic servicing, as well as for wavefront sensing and control for coronagraphs. NASA has recently appointed an AI position that reports to the Admin. A participant commented that it might be worth incentivizing the use of new ML/AI techniques in AOs. For example, Goddard is using AI to evolve lightweight structures and components. Dr. Clampin said that the Emerging Technologies Workshop will have this as a topic, and that application of quantum technologies is another underutilized area for APD.

July 24, 2024

Welcome

Dr. Tremblay re-opened the meeting.

AWESOM SAG Update

Dr. Ryan Hickox, co-chair of the Astrophysics with Equity: Surmounting Obstacles to Membership (AWESOM) Science Analysis Group SAG, provided an update, first identifying the other co-chairs, Drs. Vallia Antoniou and Christian Soto. The charge of the AWESOM SAG, a cross-Program Analysis Group (PAG) SAG, (Physics of the Cosmos PAG, Cosmic Origins PAG, and Exoplanet Exploration PAG), is to study how to expand the range of institutions and backgrounds for members of the community contributing to NASA astrophysics. The SAG will focus specifically on engagement with research and training programs, and how to make available opportunities clearer and easier to access. The SAG was initiated in Fall 2023, and employed Working Group meetings to conduct research and analysis. The SAG

is currently in the process of presenting findings and continuing its discussion, with the aim of finalizing its report at the end of 2024. The AWESOM SAG works in coordination with ongoing Diversity Equity and Inclusion (DEI) efforts at NASA.

The SAG's four independent Working Groups (WGs) cover: WG 1. overview of the landscape of astrophysics at MSIs, CCs, PUIs, etc.; WG 2. overview of existing and ongoing NASA initiatives as well as research projects and funding opportunities at MSIs, CCs, PUIs, etc.; WG 3. student training programs and bridge programs; and WG 4. IDEA best practices in NASA science. The WGs held biweekly meetings, which involved community information gathering, discussions with experts, and presentation of case studies.

Working Group 1
Dr. Dave Pooley described WG 1 activities. The WG has eight members, exclusive of co-chairs, including one undergraduate. The WG formulated a list of information to be gathered from faculty and post-docs as to level of research activity, and reached out to NASA Headquarters, STScI and the Chandra Grants office for proposal statistics, and engaged the Director of the Center for Evaluation and Research for STEM Equity at UW to help design survey and give guidance on deployment. The plan is to open the survey shortly after the start of the school year, to a targeted list of astronomers at MSIs, CCs etc., in Texas and California. The WG will also survey the entire community through an email blast via AAS, after which it will analyze and summarize results and include them in the final report. Dr. Sarah Tuttle asked if WG 1 was connected with NASA Space Grants in the states. Dr. Pooley asked for contact information to facilitate these connections.

Working Groups 2 and 3 (combined effort)
This WG has carried out in-depth research on a wide range of NASA and NSF programs; an incomplete list includes NASA Research Initiation Awards, NASA ADAP/Astrophysics Theory Program, NASA Hubble Fellowship Program, and FINESTT. The WG is considering the challenges and opportunities for smaller institutions in engaging with multi-institution projects, and limitations on use of data and or engagement with outreach/education/student training. The research infrastructure landscape is complex, so the goal is trying to understand where opportunities lie. The WG is examining classified programs and competing mandates as general AP research, new projects at under-resourced institutions, and partnerships with R01/research centers.

Working Group 4
WG 4 has compiled list of existing training programs that support students (from high school through graduate school), bridge programs, and post-baccalaureate opportunities, and divided the list into four sub-categories: programs for high-school students, undergraduates, graduate students, and bridge programs. The WG gathered publicly available information on each program, compiled points of contact for each program and is now in the process of contacting program representatives to seek additional information. Expected findings include summary of programs, successes and challenges, and identification of areas where additional NASA support could supplement or expanding ongoing efforts to improve access to and effectiveness of training programs.

Working Group 5
Focused on DEI at NASA, WG 5 completed a large-scale literature review to identify "DEIA best practices in astrophysics," identified over 100 unique recommendations, and categorized them based on 7 goals from the Astro2020 Decadal Survey's State of the Profession chapter. It also compiled a list of roughly 15 best practices synthesized from the most common, generally applicable recommendations, and produced a categorized database of all reviewed recommendations, which can be queried by keywords.

<u>Afternoon Public Session</u>

SPHEREx

Dr. James Bock presented details of the SPHEREx mission, which will provide a rich all-sky spectral catalog. SPHEREx is a relatively small, compact telescope, 2 meters tall, with 6 spectrometers that span the 0.75-to-5 micron range. A linearly variable filter sits on top of the detector. The telescope needs multiple pointing, and a particular source takes 51 exposures, but meanwhile the telescope is looking at the whole sky. SPHEREx will reside in LEO, and is passively cooled with a series of radiating extensions. The instrument is performing basically perfectly, at present. Dr. Bock displayed a focal plane spectral calibration movie. Full focal plane spectral calibration was completed some months ago, showing a little bit of leakage but working exactly as designed. Sensitivity is near best-case performance in bands 1-4, exceeding science requirements by factors of 2.5 to 4. Sensitivity is in the middle of phase A range for bands 5-6, and exceeding science requirements by factors of 60-75. The instrument passed its vibration test and is now integrated at BAE, where it underwent thermal-vacuum testing from June to early July. As a result of testing, some anomalies were uncovered with the reaction wheels, and some oscillations in a readout channel in Band 6 were found. A prime MWIR decontamination heater failed to open (but the redundant heater remained). Causes have been identified, and the mission team is now developing solutions that fit in the funded schedule reserve of 62 days (vs. 24 days required). The full science program for SPHEREx was restored at KDP-D in January of this year, after an initial cut. Products and tools include (slide). Core science pipeline development (slide)- working now on proto-pipelines, proto-pipeline (70% capability) for level 4 science team will be ready to run at launch.

Asked about the spectral decomposition of the deep field mapping, and how challenging it is to figure out all the different components, and how confident the mission is about the proto-pipeline, Dr. Bock said that interpretation is a critical capability, and is very model-dependent, especially for the low-redshift foreground, so it is not in the requirements. SPHEREx will produce a redshift catalog of galaxies, to be correlated with the spectral maps. This gives the spectrum of clustering at low redshift. It's not a guarantee, but it's a robust method that is unbiased to instrument noise and most sources of systematic error. One can understand foreground emission from that measurement. Dr. Holley-Bockelmann said it seemed like the reaction wheels were more than a hardware problem, and asked about schedule mitigations, if any. Dr. Bock said there would be regression testing on the wheels, and that there would be a testing period at observatory level when the wheels come back. He felt there was enough schedule, but noted that the wheels are the biggest concern, as they will have to be de- and re-integrated.

FINESST

Dr. Antonino Cucchiara presented findings from the Future Investigators in NASA Earth and Space Science and Technology (FINESST) working group (WG), established early in 2024 to identify possible improving strategies that will allow the FINESST program to provide a more customized offering for differing students/faculty needs; enable all type of institutions to be competitive by lowering barriers to access; and provide a more fair and higher quality review at par with other R&A programs. FINESST is a cross-divisional program element (F.5) that supports graduate student designed research projects relevant to SMD goals, with awards of up to $50k/year for a maximum of three years.

The FINESST WG identified several areas needing improvement:

- Low success rate (~11% in 2022 despite funding allocation of $2.5M, 7.6% in 2023)
- Concentration of awards: 6% of submitting institutions received 30% of awards
- Low rates of submission by certain types of institution (e.g. R2, R3, MSIs)
- Complexity in the ROSES F.5 language:
- Eligibility criteria for graduates from 4-year institutions may result in a critical barrier to access
- Full solicitation is 42 pages long (as it includes 5 divisions)
- Requires full budget

In FINESST (all divisions), student research proposals are evaluated together (1st to 6th+ years), raising fairness concerns. In addition, the current APD review process (mail-in) is non-optimal and changing to a full panel discussion would increase the SMD/APD financial burden.

Ideas to improve the current FINESST model include:

- Limiting the number of applications submitted per "Linked organization" to APD in any cycle
- We could introduce an exception for R1 PIs who decide to mentor FIs at other nearby
- universities (non-R1)
- Limiting the number of active FINESST grants per institution (e.g. max of 2-3)
- Remove the detailed budget request at submission (lowering barriers for less resourced institutions)
- Increase yearly maximum award amount (from $50k to $70k)
- Redefine the scientific areas of interest in the solicitation to be eligible to submit (like PSD)

Implementing some of these strategies may result in increasing the success rate (up to 25%) and provide a higher quality review process (e.g., better feedbacks to the proposers). It will not help APD in capturing the breadth of the astronomical community as we embrace the core value
of inclusion and foster diversity of thought. It will also be costly in some cases.

Asked if the WG had reached out to R2s that did not apply to FINESST, Dr. Cucchiara said it had not, but that 38% of FINESST reviewers are R2s; they can be queried as to why they don't apply.

Dr. Cucchiara introduced the concept of a possible APD-focused new program: STudent Astrophysics Research Grant (STAR Grant), designed to support the research (or potential) of early career students (Master- or PhD-bound students), that can advance Astrophysics and fulfill NASA objectives. Projects could be at a well-defined stage, e.g. latter years of PhD projects, or at an early stage, but would have potential for great discoveries (early grad students, M.S.). STAR would also support/increase diversity of thoughts (NASA strategic goals) and serve the broader spectrum of astronomical community and its research endeavors, because transformative ideas are everywhere. STAR could help support the next generation, using a funding model similar to FINESST (duration of award up to 3 years, with the possibility of paying the students through different mechanisms, which are similar to current model). Unlike under FINESST, the STAR award amount would be up to $70-$75k/year, establishing a "Early Graduate Studies" funding level for up to 2 years. Solicitation language would identify just two main budget lines: student research funds (salary, travel) and university student costs (IDC, fixed fees). No detailed budget will be requested at submission, just budget caps. Full budget would be required only from the awarded PIs (e.g. ADAP-24)

Proposed critical changes are:

- Having a two-tiered system with different audiences and purposes: more fair competition, responding to differing needs of the candidates/institutions, as well as better alignment to NASA APD scientific objectives
- Limiting the number of active awards or submissions by same "Linked Organization" to create a higher quality and manageable review process
- Providing a full panel review for deeper scientific review discussions

Dr. Cucchiara asked for APAC feedback, noting that if the STAR concept were to be positively received, APD would start planning for ROSES-25. APAC discussed the number of reviewers needed in a given year (more than 120). Dr. Jogee said reaching out to R2s, to see what might really help, would be valuable. She added that she worried that some R2s don't have enough overhead to participate in NASA

grant programs, and that some students don't have the resources to apply. Asked if the level of funding would be increased, Dr. Cucchiara said that No, the program would have the same level of resources. STAR is a pilot, with fewer awards, but the expectation of increasing the quality of reviews and feedback, and the success rate, eventually. Dr. Jogee commented that APD should consider evaluation criteria, and how the grants might broaden impact on underserved institutions. In addition, APD could hold help sessions to walk students through application processes.

Public Comment Period

-Asantha Cooray- The APAC had similar discussions in 2019, when one recommendation was to allow MUREP-funded students to stay in the NASA pipeline as they go up the chain. Dr. Tremblay said he had this noted, and was aware of the recommendation.

- In a question related to the NASA Hubble Fellowship: what is the balance between AP fellowships and GO grants, can you trade these off? Dr. Clampin said he was not planning to move the Hubble Fellowship program, and there is no plan to trade grants between GO and AP fellowships. APD does not want to reduce the size of the Fellowship Program.

-Are there any plans to service HST? Dr. Clampin said there is no plan to provide new gyros, but APD has studied a plan to re-boost the HST to a higher orbit. XRISM does not lend itself to services, but the team will continue to attempt to open the gate valve.

-Budget question- what weight can be placed on the FY25 PBR for the HST Operational Plan? 98.3M? Dr. Clampin said that NASA has a signed Operations Plan that will keep spending at the 98.3M level for HST.

-In response to a question about mandated budget reductions to NASA, Dr. Clampin reiterated that NASA must work within budget its appropriated budget.

-Asked if NASA had a rationale for cutting positions before an appropriations budget is known, Dr. Clampin noted that NASA received its appropriation language in April the last time, which was well into the fiscal year. NASA still must work within the existing budget.

-What is the role of Congress, etc, for advocating for AP? Dr. Clampin said that NASA is not permitted to advocate for its budget.

-Dr. Sarah Tuttle said, for the record, that APAC will be commenting on OPCR.

Discussion/debrief

Dr. Tremblay noted that in the event of a Continuing Resolution, NASA would not need a new Operating Plan. Dr. Oppenheimer said she wanted to state for the record that the Astrophysics community must face the fact that both HST and Chandra will cease; it is amazing that they have lasted as long as they have. Dr. Holley-Bockelmann emphasized that she wanted to acknowledge Dr. Clampin's herculean efforts, and that it is very clear that he is trying his best in an impossible situation, and that he is trying his best for the entire Astrophysics community. Dr. Tremblay seconded the sentiment. Dr. Jogee-asked how Dr. Clampin makes the pivotal decisions when the appropriations bill finally arrives. Dr. Clampin said that he makes the decisions, ultimately, but these decisions are presented to the SMD and reviewed by the Associate Administrator (AA), who can agree or disagree. The AA then takes the budget to the Administrator level, and using findings from various reviews, takes them under advisement as the FY25 budget is worked. If NASA gets an appropriation with excess funds, it may have to revise the budget based on any accompanying Congressional language. Dr. Jogee asked: when is an appropriation too late? Dr. Clampin said that to avoid significant adjustments late in the year (in the case of a late appropriation), NASA must hew to existing budget while anticipating the new budget. In addition, a heavily earmarked budget could make things more difficult.

Findings and Recommendations

Dr. Tremblay noted an APAC concern about COSI and the remaining margin on the germanium detectors. Dr. Clampin agreed that getting the detectors delivered is critical. The Program Scientist associated with COSI commented that they are doing fine. Dr. Tremblay, referring to Antarctica

infrastructure, asked about going to the General Assembly to talk about balloon flights from South Africa. Dr. Clampin said that NASA does not launch from South Africa, but occasionally balloons will fly over that country. NASA also flies from McMurdo Station, where there are some restricted dormitory slots; the flights depend on how many personnel NASA can send. A participant commented that (balloon) teams seem to be getting smaller, with diminished opportunities. Dr. Clampin said he would take the comment under advisement, and that APD is still awarding small teams in the HST and Chandra programs.

OPCR
Drs. Gaskin and Tremblay recused themselves from the discussion. Asked if there were a plan to augment people doing analysis on LISA and ATHENA. Dr. Clampin said there was no formal program yet, but that an APAC recommendation would be useful. Asked if 15% budget growth between 2024 and 2028 could be achieved, Dr. Clampin said that the PBR and outyears do not support this. Dr. Jogee asked if there was any broader thinking or mechanism to mitigate this constrained cycle, Dr. Clampin said that the overall budget process is determined by the federal government, but that NASA is accustomed to both good years and bad: not every budget is like this. In addition, APD moved up the Senior Review to get maximum community input to inform the budget process; this serves the community much better.

Senior Review
Asked to comment on the subcommittee process vs. Contractor for the Senior Review, Dr. Clampin noted that all the other divisions in SMD used a contracted task for their mission Senior Reviews. Dr. Sparke commented that there had been instances in which people had refused to work as part of a subcommittee, as they were reluctant to file the required financial disclosures; thus APD decided it was easier to use the contracted task. Dr. Tremblay noted for the record that APAC had received many emails on the subject.

SAT $10M cubesat proposal; major revision to scope of SAT
Dr. Regina Caputo said that the SAT proposal would also allow tech development flights, which wouldn't have to have a science case. She supported Dr. Benford's recommendations, which would also be beneficial to SAT, in simply tying it to potential future flight opportunities, and not exclusively to strategy. An APAC member expressed concern that SAT has only a limited number of topics. Another member agreed with this concern. The SAT has demonstrated great success over the last 15 years, and has provided instrumental capabilities. Dr. Stephen McCandliss said that there are partnerships between APRA and SAT that offer APRA-level flight access, which are already in place and being taken advantage of. Dr. Oppenheimer agreed that SAT is very important, but that it is not the only one that does what it does. A lot of coronagraph technology was developed at NSF. Dr. Jessica Gaskin said she wanted to talk about the future of SAT and APRA at the next APAC meeting; perhaps there is a cheaper Pioneers maturation project vs. a larger mission. APAC might want to consider an alternate funding path to tech maturation, e.g. the CubeSat line. NASA needs to think outside of the box; it's getting more expensive. Another member suggested clarifying what fits into SAT, and what its purpose is.

TDAMM Comms Sat report
The APAC accepted the report findings by unanimous consent. Dr. Clampin appreciated APAC's endorsement. Dr. Tremblay noted that APAC will accept the report, accompanied by a minor finding co-written by 2 APAC members.

SCaN
Dr. Gaskin said that there is some trepidation about the state of commercial communications market, in terms of interoperability; there is still a long way to go. Dr. Clampin noted that APD is moving into a data-heavy, alert-oriented era. Is the TDAMM community aware of this issue? An APAC member commented that they thought the missions are aware, but not the wider community. An APAC member observed that other sectors (such as national security) are going to the commercial markets, and commercial markets are investing heavily in satellite communications. NASA is not alone.

AWESOM SAG
The APAC discussed the general support requested from the SAG, and the survey question. Asked if the TOR contains survey language, Dr. Jogee suggested that APAC should caution the SAG on survey fatigue, and also reach out to Society of Black Physicists and similar groups such as SACNAS, and coordinate what already exists, and coordinate additional data-gathering. Also, the SMD Bridge Program may have collected some of the same data. She added that the survey language should avoid the use of "DEI", because of state restrictions. A participant commented that the AWESOM group did look at existing data before suggesting a survey.

FINESST
A participant commented on the onerous university referee process and that it is hard to get people to sit on review panels. One would also guess that it is challenging for a university to get a budget together, which is why R2s typically do not propose. A new NASA grant model may encourage more proposals. Undergraduates can apply to NSF, but the funding does not guarantee admission to a university. It is also imperative to have faculty oversight for NASA grants, as too many students will crash and burn without advisors. Dr. Jogee suggested that FINESST talk to the R2s and ask them why they do not apply; she felt they might say that there is no support for a student to write proposals, and that a simple 2-hour online workshop might help. Dr. Tremblay suggested capping the number of active awards. There were no objections noted to this idea. He asked whether the Roman and Rubin missions could jointly fund preparation work, and added for the record that Roman and Rubin (DOE) people talk all the time.

SPHEREx
APAC is rooting for SPHEREx.

PAGs
The APAC has read all the reports, which were gratefully received, with no actions requested. Dr. Tremblay said that many people are worried about deadlines, and bad timing. Dr. Ilaria Pascucci said that ExoPAG continues to be concerned about proprietary periods. Dr. Clampin said he was taking these concerns under advisement, and that there are no current plans to change proprietary periods. He added that he couldn't speak for the Planetary portion of the Exoplanet community in that regard. Dr. Tremblay, referring to a comment in the chat, said that the commenter had asserted that budget woes are considered neither here nor there for R2 proposers.

APAC extended kudos to Dr. Clampin for two years on the job. Dr. Clampin thanked departing APAC members for their service. The meeting adjourned at 5:01pm.

Appendix A
Attendees

APAC Members

Kelly Holley-Bockelmann, **Chair**, Vanderbilt University
Daniela Calzetti, University of Massachusetts, Amherst
Regina Caputo, NASA Goddard Space Flight Center
Hsiao-Wen Chen, University of Chicago
Jessica Gaskin, NASA Marshall Space Flight Center
Erika Hamden, University of Arizona
Shirley Ho, Flatiron Institute
Shardha Jogee, University of Texas, Austin
Alina Kiessling, Jet Propulsion Laboratory
Mark Mozena, Planet Labs Inc.
Rebecca Oppenheimer, American Museum of Natural History
Ilaria Pascucci, University of Arizona
Grant Tremblay, Harvard-Smithsonian Center for Astrophysics
Sarah Tuttle, University of Washington
David Morris, **Executive Secretary,** NASA HQ

Attendees

Abdu Zoghbi
Abel Mendez
Adam Goldstein
Adi Foord
Aidan Pidgeon
Aki Roberge
Alaina Henry
Alberto Noriega-Crespo
Alexander Kutyrev
Alexander Rudat
Alexey Vikhlinin
Alicia Canipe
Alise Fisher
Allison Youngblood
Alyssa Guzman
Amanda Pagul
Amber Straughn
Amir Shahmoradi
Amy Jones
Andi James
Andrew Schnell
André Martel
Andy Fox
Annalisa Calamida
Annalisa De Cia
Anne O'Connor
Antonella Fruscione
Antonino Cucchiara
Aparna Chitre
Arielle Moullet
Ashlee Wilkins
Ashraf Moursi
August Muench
Barbara Grofic
Ben Proudfoot
Ben Sunnquist
Bernard Kelly
Bethan James
Bev LaMarr
Bindu Rani
Brad Wargelin
Brandon Bethune
Brandon Lawton
Breana Branham
Breann Sitarski
Brett Morris
Brian Brooks
Brian Humensky
Brian Williams
Bryan Hilbert
Catherine Barclay
Catherine Grant
Charles-Philippe Lajoie
Chien-Ting Chen
Chris Roberts
Chris Stark
Christine Pulliam
Christopher Clark
Claire Blome
Claire Murray
Claude Canizares
Clev Cong
Colleen Wilson-Hodge
Corneilius Robinson
Cristina Oliveira
Dan Burger
Dan Coe
Daniel Castro
Daniel Clery
Daniel Stapleton
Dave Haskins
Dave Leisawitz

Dave Pooley
David French
David Gerdes
David Millman
David Morris
David Richardson
David Sahnow
David Shoemaker
David Stark
David Thilker
David Traore
Dean C. Hines
Debbie Fairbrother
Debra Wallace
Denise Smith
Dominic Benford
Doris Daou
Juan Roman
Drew Miles
Durgesh Rai
Edwin Griego
Elena Manjavacas
Elijah Owuor
Emily Kosmaczewski
Emily Wislowski
Emma Marcucci
Eric Miller
Erik Wilkinson
Eunkyu Han
Evgenya Shkolnik
Francesca Boffi
Francesca Civano
Francesco Bordi
Fred Dauphin
G Varsi
G Bacon
Gagandeep Anand
Gagandeep Kaur
Gail Rohrbach
Gene Mikulka
Gerrit Schellenberger
Grace Telford
Grant Tremblay
Greg Mosby
Gregg Germain
Gregory Heckler
Griffin Reinecke
Richard E. Griffiths
Hannah Braun
Hannah Jang-Condell
Hannah Wakeford
Harry Teplitz
Harvey Tananbaum
Heidi Hammel
Helmut Jenkner
Hussein Jirdeh
Ingrid Farrell
J. M. Vrtilek
Jacob Taylor
Jacqueline Hernandez
Jake Aznavorian
James Bock
James Lochner
James Thorpe
Janet Letchworth
Janice Lee
Jason Araujo
Jason Derleth
Jason Tumlinson
Jean Connelly
Jean Dupuis CSA
Jean Toal Eisen
Jeff Booth
Jeff Foust
Jen Lotz
Jenna Ryon
Jennifer
Jennifer Baker
Jennifer Kearns
Jennifer Mack
Jennifer Wiseman
Jeyhan Kartaltepe
Jim Jeletic
Jim Manning
Jo Taylor
Joan Zimmermann
Joe Burchett
Joel Roediger
John Dyster
John Mackenty
John Maple
John O'Meara
John Wisniewski
Johnathan Watts
Joleen Carlberg
Jonathan Hargis
Josh Schlieder
Joshua Lothringer
Joshua Wing
Juan Roman
Julia Roman-Duval
Julie Stoltz
Justin Finke
Karl Heinz
Kate Rowlands
Katherine Chavis
Keith Jahoda
Kelsie Krafton
Ken Carpenter
Ken Kohls
Kim Arcand
Kim Weaver
Knicole Colon
Kristen Garofali
Kristen McQuinn
Ky Huynh
L Curtis
Larry Petro
Marie Wingyee Lau
Laura Watkins
Lauren Miller
Laurence David
Leonardo dos Santos
Lewis Groswald
Lisa Kewley
Liz Hays
Liz Wheatley
Lou Strolger
Lucas Paganini
Lulu Zhao
Lynnae Quick
M Diaz
Miguel Angel Vargas Cruz
MaggieBeth Turcotte
Malgosia Sobolewska
Marc Postman
Marc Rafelski
Marcia Smith
Marco Chiaberge
Margaret Carruthers
Margaret Meixner
Mariah Baker
Mario Gennaro
Mario Perez
Marjorie Decleir
Mark Bautz
Mark Clampin
Mark McConnell
Mark Schattenburg
Martha I. Saladino
Marufa Bhuiyan
Matt Dallas
Matt Lallo

Matthew Bolcar
Matthew East
Mayra Montrose
Meaghan McDonald
Megan Ansdell
Megan Lin
Megan Watzke
Mercedes López-Morales
Michael Allen
Michael McDonald
Michael McElwain
Michael Menzel
Michael Meyer
Michael Werner
Michelle Hui
Mike Corcoran
Mike Davis
Mike Stevens
Ming Sun
Misty Bentz
Misty Cracraft
Misty Provost
Morgan Van Arsdall
N Wolk
N. Lee
Nancy Levenson
Naseem Rangwala
Neill Reid
Nell Greenfield Boyce
Nicholas White
Nicolas Flagey
Nimish Hathi
Norman Grogin
Oksana Pavlyk
Opher Ganel
P.L. Lim
Pat Slane
Patricia Knezek
Patrick Coronado
Patrick Crouse
Patty Reeves
Paul McNamara
Paul Plucinsky
Paul Ray
Peter Edmonds
Peter Kurczynski
Peter Maksym
Peter Schemmel
Phil Kaaret
Phil Puxley
Phil Scott
Quyen Hart
Rachael Beaton
Rachel Osten
Rachel Plesha
Rachel Rivera
Rachele Cocks
Raffaele D'Abrusco
Ralf Heilmann
Ralph Kraft
Ray Lucas
Ray Villard
Ricky O'Steen
Rita Sambruna
Rob Kennicutt
Rob Petre
Roberto Avila
Ronald Gamble
Rosa Diaz
Roy Kilgard
Ryan Hickox
Ryan Martineau he/him
Susan Neff
Sang Park
Sangeeta Malhotra
Sapna Mishra
Saurabh Jha
Scott Wolk
Sean Johnson
Sean Terry
Shardha Jogee
Shari Lifson
Shawn Domagal-Goldman
Shouleh Nikzad
Sierra Gomez
Simon Bandler
Steph LaMassa
Stephen Cenko
Stephen Clark
Stephen O'Dell
Steve Groom
Steve Unwin
Steven Ehlert
Suvi Gezari
Swara Ravindranath
Terence Doiron
Tonia Venter
Tamara Bogdanovic
Tammy Dickinson
Teresa Jensen
Tess Jaffe
Thomas Connor
Thomas Wevers
Tiffany Lewis
Tom Barclay
Tom Brown
Tri L Astraatmadja
Tsulon Li
Tyler Desjardins
Van Dixon
Vandana Desai
William Zhang
William Jones
William Schultz
Wilton Sanders
Wm. Horne
Yaswant Devarakonda
Zoe Wai
Chris Evans
David Huenemoerder
Doug Swartz
Lorella Angelini
Mark Matsumura
Megan Sosey
Meredith Powell
Peter McCullough
R Cooper
Richard Rogers
Sanaz Vahidinia
Sherie Holfeltz
Christian Soto
Damien Soup
David Morris
Donnie Miller
Eric Smith
Grace Hu
James Facer
Joshua Diaz
Linda Sparke
Marufa Bhuiyan
Paul McNamara
Regina Caputo
Shahid Habib
Suvrath Mahadevan
Terry Davis

Appendix B
Agenda

Astrophysics Advisory Committee
July 23-24 2024
Virtual (WebEx info below)
Time Zone: Eastern
Tuesday 23 July
9:00 a.m. Introduction and Announcements David Morris/Kelly Holley Bockelmann
9:05 a.m. Astrophysics Division Update Mark Clampin
11:00 a.m OPCR Committee Report Rob Kennicutt
11:30 a.m. OPCR Discussion APAC members
12:00 p.m. Public Comment Period
12:15 p.m. Lunch
1:15 p.m. Senior Review CFP Presentation Linda Sparke
1:45 p.m. Senior Review CFP Presentation Disc APAC members
2:00 p.m. APD Tech Dev/Small Mssn Balance Dominic Benford
2:30 p.m. APD Tech Dev/Small Mssn Balance Disc APAC members
3:00 p.m. Break
3:15 p.m. Post-TDRSS Comms SAG Report Jamie Kennea
3:45 p.m. SCaN Comms Presentation Greg Heckler
4:15 p.m. Comms Discussion APAC members
4:45 p.m. Wrap up for Day 1 Kelly Holley-Bockelmann

Wednesday 24 July
9:00 a.m. Opening Remarks Hashima Hasan/Kelly Holley Bockelmann
9:05 a.m. AWESOM SAG Update Ryan Hickox
9:35 a.m. AWESOM SAG Discussion APAC members
10:00 a.m. FINESST Update Nino Cucchiara
10:30 a.m. Break
10:45 a.m. PAG Updates Ilaria Pascucci/Athina Meli/Shouleh Nikzad
11:30 a.m. SPHEREx Update Jamie Bock
12:00 p.m. Roman Update Vanessa Bailey/Joshua Schlieder
12:40 p.m. Public Comment Period
12:50 p.m Discussion of APAC Topics from the Community APAC members
1:00 p.m. Lunch
2:00 p.m. Discussion APAC members
3:00 p.m. Presentation of APAC Charge

3:30 p.m. Formulate Recommendations APAC members
4:00 p.m. Debrief Division Director APAC members
5:00 p.m. Adjourn

Appendix C
APAC Membership

Kelly Holley-Bockelmann, **Chair**
Vanderbilt University

Daniela Calzetti
University of Massachusetts, Amherst

Regina Caputo
NASA Goddard Space Flight Center

Hsiao-Wen Chen
University of Chicago

Jessica Gaskin
NASA Marshall Space Flight Center

Erika Hamden
University of Arizona

Shirley Ho
Flatiron Institute

Shardha Jogee
University of Texas, Austin

Alina Kiessling
Jet Propulsion Laboratory

Mark Mozena
Planet Labs Inc.

Rebecca Oppenheimer
American Museum of Natural History

Ilaria Pascucci
University of Arizona

Grant Tremblay
Harvard-Smithsonian Center for Astrophysics

Sarah Tuttle
University of Washington

David Morris
Executive Secretary, NASA HQ

Appendix D
Presentations

1. Astrophysics Division Update- Mark Clampin
2. OPCR Committee Report - Rob Kennicutt
3. Senior Review CFP Presentation - Linda Sparke, J. Letchworth
4. APD Tech Dev/Small Mssn Balance - Dominic Benford
5. TDAMM Comms SAG Report - Jamie Kennea, J. Racusin
6. SCaN Comms Presentation - Greg Heckler, P. Schemmel
7. FINESST Update - Nino Cucchiara
8. AWESOM SAG Update - Ryan Hickox
9. SPHEREx Update - James Bock