Minutes of the Meeting of the
Astronomy and Astrophysics Advisory Committee
21-22 September 2020

Members attending:

Nancy Chanover
John O'Meara (Chair)
Ian Dell'Antonio
Scott Dodelson
Eliza Kempton
Deidre Shoemaker
Alexie Leauthaud
Andrew Connolly
Stephan Meyer
Mansi Kasliwal
Kyle Dawson (Deputy Chair)
Priyamvada Natarajan
Petrus Martens

Agency personnel:

Martin Still, NSF-AST
Renee Adonteng, NSF-AST
Nigel Sharp, NSF-AST
Michelle McCrackin, NSF-NSB
Randy Phelps, NSF-OIA
Zoran Ninkov, NSF-AST
Marcus Seigar, NSF-AST
Elizabeth Pentecost, NSF-AST
Sarah Higdon, NSF-AST
Glen Langston, NSF-AST
Joseph Pesce, NSF-AST
Hans Krimm, NSF-AST
David Boboltz, NSF-AST
Ralph Gaume, NSF-AST
Edward Ajhar, NSF-AST
Luke Sollitt, NSF-AST
Harshal Gupta, NSF-AST
Jonathan Williams, NSF-AST
Swati Sureka, NSF-MPS OAD
Linnea Avallone, NSF-GEO OAD
R. Chris Smith, NSF-MPS OAD
Steve Shih, NASA
Stefan Immler, NASA
Aki Roberge, NASA
Jeffrey Hayes, NASA
Allison Farrow, NSF-AST
Sarah Higdon, NSF-AST
Carrie Black, NSF-AST
James Neff, NSF-AST
Donna O'Malley, NSF-AST
Chris Davis, NSF-AST
Pedro Marronetti, NSF-PHY
Vladimir Papatashvili, NSF-Polar
James Whitmore, NSF-PHY
William Latter, NASA
Paul Hertz, NASA
Hashima Hasan, NASA
Valerie Connaughton, NASA
Kartik Sheth, NASA
Daniel Evans, NASA
Patricia Knezek, NASA
Eric Linder, DOE
Kathy Turner, DOE
Helmut Marsiske, DOE
David Cinabro, DOE
Hannah Jang-Condell, NASA
Mario Perez, NASA
Eric Tollestrup, NASA
Pamela Marcum, NASA
Jeanne Davis, NASA

Others:

Fiona Harrison, Caltech
Nick Saab
Pat McCarthy (NOIRLab)
Adam Bolton, AURA/NOAO
James Lochner, USRA
Michael Ledford
Steven Kahn
Francesco Bordi
Tricia Crumley
Beth Willman
Karl Stapelfeldt, JPL
James Murday, USC
Mark Kushner
Phil Puxley, IAU
Dana Lehr, AURA
John Callas
Ashlee Wilkins
Monty Di Biasi
Eric Feigelson
John Mester

Christopher Jones	Gary Blackwood
Kate Von Holle	Mark Dickinson
Lee Curtis	Naomi Webber
Jim Murday	Drew Baden
Jeff Foust	David Millman
Sylvie Espinasse	Harvey Tananbaum
Steve Unwin	Brian Beckford
Stephanie Green	Nick Saab
Grant Tremblay	Constance Walker
Jeff Hall	Scott Smas
Dara Norman	Stephen Clark
Bob Blum	Azita Valinia
Gary Zank	

MEETING CONVENED 10:00 AM, 21 SEPTEMBER 2020

Ralph Gaume reviewed the rules, membership, and duties of the AAAC. John noted that the September meeting is typically in-person, and encouraged use of the raise-hand feature in the Zoom platform, and then proceeded with the introductions. New committee member Alexie Leauthead. The next two meetings are scheduled: January 26-27, 2021 and February 24, 2021. February's meeting is February meeting is almost singularly focused on preparing for the report and/or an analysis of the administration's budget guidelines.

Agency Program Updates

NASA

Paul Hertz provided an update on NASA Astrophysics activities.

NASA has recently added a fifth core value for the agency – inclusion. There have been several studies and evaluations on ways to make the agency and SMD more inclusive, including from NASEM, a diversity, equity, and inclusion (DEI) working group, and equity audits done at NASA headquarters. NASA's APAC will be meeting next month, and is allowing community input, which can be done here: https://science.nasa.gov/researchers/nac/science-advisory-committees/apac/. NASA will be responding to the APAC recommendations of DEI.

NASA is prioritizing funding extensions to graduate students, postdocs and early career soft-money researchers during the pandemic.

Some science highlights were presented.

- Mars 2020, with the Perseverance rover and the Ingenuity helicopter, launched back on July 30 is on its way to Mars, landing in February 2021. This international partnership is the most complex robotic program that NASA has attempted.
- Betelgeuse dimming.
- Discovery of a Jupiter-sized planet around a white dwarf in a 34 hour orbit.

Missions in Operation and Development: Most of the Science Operations Center staff are working

remotely. The SOFIA airborne observatory cannot be operated remotely and it did cease operations back in March, and continued flying again in August. The balloons campaigns in 2020 have been canceled. Chandra did have a failure back at the end of August, the A-side high voltage supply on the high-resolution camera. The B-side electronics had been turned off for 21 years since commissioning; a swap was performed and full recovery is expected. GUSTO is an ultra-long duration balloon payload, which will be launching from Antarctica within cost and schedule despite the pandemic. A XRISM team traveled to Japan to troubleshoot a leak in XRISM's dewar, causing some delay.

All missions in development are suffering reduced efficiency due to the pandemic. The ripple effect of supply chain disruptions will be felt for some time.

James Webb Space Telescope: environmental (acoustics, vibration) testing is still underway at Northrop Grumman Space Park to ensure launch in October 2021 is on track.

NASA is ramping up their community active community involvement in Roman now that it is in phase C - all the observing time will be available through open processes. A majority of the prime mission will be used to do legacy surveys and these legacy surveys will enable the dark energy and exoplanet science that was prioritized in the decadal survey, but they will enable much more.

IXPE will be NASA's next explorer to launch. It is an X-ray polarimetry mission and will be the first sensitive x-ray polarimetry mission to study black holes and supernova remnants, measure their magnetic fields, and study their internal architecture.

R&A funding: Over the last five years, NASA has continued to decrease how long it takes to tell the proposer whether or not the proposal has been selected. This year, it was an average of 111 days from the time it was submitted to the time one received a notification as to whether the proposal was selected or not. The NASA requirement is 180 days. This year, we had 100% of notifications in under 150 days, including the time we've been teleworking.

Dr. Kasliwal asked a question about the Hubble Fellows program. Dr. Hertz's response was that the current fellows would not be impacted by the deteriorating job market; if any Fellows are impacted, their fellowship could be extended. That would be at the expense of selecting new future fellows.

Dr. Dell'Antonio asked whether the diversity activities are public, and Dr. Hertz's response is that they are.

Dr. Natarajan wanted to know what limitations would prevent the Webb proposal deadline from being delayed until after the holidays to accomodate the teachers struggling with the COVID circumstances. Currently, the due date will not be moved, replied Dr. Hertz, though case-by-case accommodations can be considered if requested.

Other questions were asked about Roman and funding charts, which were referenced on the slides presented.

Some COVID questions were asked, and NASA's response is that, like all years, funding is based on the annual appropriation, and currently, no COVID augmentation for NASA seems to be under consideration in any proposed legislation.

Dr. O'Meara closed the NASA section by thanking Dr. Hertz and the agency on efforts, especially regarding DEI and offers support from the committee in any way the AAAC can, such as language in reports.

DOE

Kathy went over the organization of the Office of Science, narrowing down to Office of High Energy Physics (HEP) Program. That program carries out three frontiers: the energy and intensity frontier, and cosmic., which uses naturally occurring data. The primary efforts are in accelerator-based physics. The program provides additional input to the standard model of fundamental matter and energy and our interactions. DOE is a mission-oriented agency – there is community input to develop a strategic plan for the program that provides significant leaps in science and capabilities. *Further information can be found in the DOE slides.*

There was a P5 strategic plan written in 2014, which provided a portfolio of facilities and projects across the program to optimally address the science within different funding levels. It's a 10-year plan with a 20-year vision. That plan made several priority projects in dark energy and dark matter and cosmic microwave background. The graph with the HEP Budget shows that funding really took off in 2016 after the report was digested; Congress continues to show financial support.

Nearly all of the HEP P5 projects are in "critical design" CD 3 or 4 (excluding CMB-S4 and PIP-II).

The next P5 strategic plan will be developed starting with a community-wide "Snowmass" process which has started.

The Cosmic Frontier Program's priorities are the study of the nature of dark energy, search for dark matter and the study of cosmic microwave background to study the inflationary era in the early universe. There also are some indirect measurements for dark matter; there's exploring the unknown, the search for new physics etc. There are cosmic and gamma ray experiments ongoing. The Alpha Magnetic Spectrometer (AMS) is operating on the ISS. Gamma-ray experiments include Fermi, the gamma ray mission and HAWC in in Mexico. For dark energy, the program is carrying out precision measurements to differentiate between if it's a cosmological constant or a new field or modification to general relativity.

DESI is ready to take data. This is the first stage four dark energy project to start operations. It's the world's premier spectrograph that's designed and built byefforts of an international collaboration (over 13 nations partners). DOE-supported and LBNL-led, this major item of equipment project was to fabricate the instrumentation, data management system and other upgrades for a DOE cost of $56 million. . Commissioning completed just as COVID arrived.

Andrew was wondering if Kathy has seen any impact of COVID on the Snowmass process in terms of community engagement or concerns about how this Snowmass process might go with the large meeting coming up. Kathy replied that all meetings are occurring virtually, with continually high community support.

Mansi asked about DESI starting to operate in an "remote mode" and when the photons will hit. Kathy replied that when people can go, for how long, and which people are still being discussed. The project director has said that there really doesn't need to be a lot of people going to Kitt Peak for operations.

Several members asked for clarification about the gender identification in PIs submitting grant proposals. Members would like a closed session with the funding agencies at a near future AAAC meeting discussing the diversity data.

Ralph answered a question about the decadal and the agencies' responses to those recommendations, as well as this advisory committee. "We take the decade of survey recommendations very seriously. But that said, none of the agencies are bound to take those recommendations. There are always other considerations that come into mind, such as budgets, such as the will of Congress, such as partnerships with other agencies."

NSF

Ralph Gaume provided an update on AST activities. He presented some highlights:

Several observatories are observing despite COVID, including NRAO, GBO, GONG and Gemini North. DKIST has restarted DKIST. ALMA has been offline since mid-March with the exception of solar and battery power for the hydrogen maser, and the cryogenic receivers will likely not start operations until December-mid-Spring. For grantees with awards expiring in September, agencies have the discretion on a case-by-case basis to extend those – more information can be found here: https://www.nsf.gov/news/special_reports/coronavirus/.

NSF staff have been allowed to continue 100% telework, with no schedule for a mandatory returning to office. There has also been no work-related travel, and all meetings are held virtually.

ALMA has been featured in several Nature papers recently - observations are showing and indicating that massive disc galaxies, not unlike the Milky Way, were formed at much earlier epics than previously believed.

The GBT and Arecibo both made news in *Nature* – the GBT discovered that a hot wind outflow from the Galactic center contains cold clouds of gas. Arecibo discovered an asymmetric mass merging binary neutron star system, the largest to date.

ALMA has detected phosphene gas in Venus's cloud deck.

NSF personnel: Dr. Córdova ended her term as NSF Director in March. Kelvin Droegemeier served as acting-Director from April 1-June 22. Sethuraman Panchanatha is our current-term Director. Anne Kinney (MPS Assistant Director) left May 1. Sean Jones has been acting, and very recently, been named the AD. Tie Lou has been the acting Deputy AD. Several new employees have joined the division, and some have left.

The Rubin Observatory was making fantastic progress before COVID hit, both on the dome and on the telescope mount.

DKIST has resumed construction, but not at 100%.

A major event happened at Arecibo on August 10, at 2:56 am, when routine observations were underway on the Gregorian feed (it was moving at the time). One of the 12 auxiliary cables detached from tower 4. Only a few hundred panels out of ~40,000 panels were damaged on in the dish. The repairs could be done on the dish and accomplished within a few weeks at minimal cost. Hurricane Maria also caused some damage to the surface of the dish that was repaired pretty quickly. Safety is the number one priority for moving forward with the Arecibo repairs. The awardee, in concert with NSF, has hired three firms to coordinate the investigation and analysis and repair planning. A full structural model is currently underway. A safety plan can only follow once the structural model is complete, which is expected to complete soon.

The TMT, GMT, and NOIRLab have all made public that they have submitted planning and design proposals to the National Science Foundation underneath the banner of the US ELT program at Maunakea, recognizing that construction of the TMT on Maunakea is a very sensitive issue.

AST is working on the budget for the current FY. There is potential for a government shutdown. Ralph went over the policy about disclosing potential budgets that haven't been passed in Congress. Should the committee wish to discuss, a possibility of a closed session with the NSF and the committee is an option.

Regarding investments, NSF divulges what they award on the web for public access.

No one yet knows what the NSF, the HEP DOE science, and the NASA astrophysics FY21 budgets are going to be since these budgets are set on a year-by-year basis. The agencies are going to have to sweat the implementation details. The most important thing for the decadal committee to do is to provide us with a program with clear explanatory decision rules. The statement of task that was written by the agencies a few years ago. That task is:

> *Utilize and recommend decision rules, where appropriate, for the comprehensive research strategy that can accommodate significant but reasonable deviations in the projected budget or changes in urgency precipitated by new discoveries or unanticipated competitive activities.*

The final slides showed responses to select AAAC recommendations.

Q&A included John O'Meara requesting the JASON report be shared with him. Andrew Connolly asked about who to talk to about COVID supplements and award changes, with Ralph's reply being your program officer at NSF – the agencies still have not received additional funding for COVID relief. Andrew suggested specifically letting the community know about speaking with your PO, which Ralph will move up the chain.

Satellite Constellations

The challenge that satellite constellations bring to the field of astronomy became acutely evident with the launch of the first set of 60 Starlinks back in May 2019. The AAS helped bring together that conversation with astronomers and SpaceX, where at January's 2020 AAS meeting with both groups presenting. That is where SATCON1 was "born". The NSF-funded workshop occurred from June 29-July 2, 2020, where presentations were made by the working group members during the first two days which included discussions with the community. During the following two days, next steps were planned and revisions on a final document started. The final report was presented to NSF by August. The report was released on August 25, at which time there was a press briefing. SATCON1 consisted of many, including astronomers, people from SpaceX, Amazon and NSF, and others. (SATCON1 focused on identifying the impact and the mitigation solutions, while SATCON2 will deal with policy. SATCON2 is planned for the third week of May.) The report is summarized on slides 9-10.

There are plenty of other applications that can benefit from satellite constellation like Internet of Things applications is that become more pervasive.

There are other broader impacts on citizen science, amateur and general stargazers worldwide, and cultural impacts for people who still use the sky for storytelling or way-finding. Slides 10-18 discuss these and other impacts to scientific and observational programs.

Connie and Jeff provided their contact for addressing any comments or concerns due to time limitations remaining for the day.

The NOIRLab Strategic Vision and Status

Chris Davis provided an update on NOIRLab activities and the strategic vision for the organization, noting that NOIRLab was launched on October 1, 2019 and is responsible for bringing together all of NSF's

ground-based optical infra-red observatories.

Time-domain astronomy is an area of increasing significance and focus. Efforts are underway to ensure NOIRLab is in position to respond to nightly time domain alerts from Rubin Observatory through its Antares and Aeon systems. Gemini and Soar are currently very involved in this network, and there is an expectation that this will be expanded in the coming years.

Gemini has a very aggressive development program underway, with several new instruments coming online over the next couple years. Some updates provided were:
Scorpio 8-beam OIR imager/spectrometer - designed primarily for time-domain usage follow-up. This is a very versatile instrument and is expected to become one of the work-horse instruments on the telescope.
The GHOST high-R optical spectrometer has been shipped to Chile and is pending commission.
GEMMA is a program that is developing adaptive optic systems for Gemini North and providing funding in support of time-domain software development.
Additional instruments such as GIRMOS and IGRINS-2 are being developed through Gemini partnerships.

The Gemini program is funded by its partners, including the US, Canada, Brazil, Rep. Korea, and Argentina. All have expressed a strong desire to continue the partnership and are in process of finalizing a new six-year agreement, expected to begin in January 2022. The Vera C. Rubin Observatory is a separately funded NSF-DOE program, with only Rubin operations falling under NOIRLab.

Despite the consolidation of services among the facilities, the aim of NOIRLab is that each of the five main programs retain their individual identities, and leadership structure. There is however value in coming together to share ideas and leverage resources and develop cross-NOIRLab programs. There have been efforts to enhance NOIRLab's virtual presence with the launch of an agency website (noirlab.edu). The websites of the individual programs will also be updated and linked to the NOIRLab hub. NOIRLab has also launched a newsletter, The Mirror, which presents an integrated program of activities for all programs within NOIRLab.

New NSF programs in ground-based OIR astronomy will be executed through NOIRLab. It was noted that NOIRLab and NSF support for US-ELTs are dependent on several milestones, including positive outcome from the upcoming Astro2020 report. Given the potential impact of the Astro2020 report for NOIRLab's direction, the organization is taking a mindful approach to decision-making and program development, operating only within its near-term strategic goals in the interim.

John O'Meara questioned whether there is an existing philosophy for how much time Gemini or other NOIRLab facilities are planning on devoting to Rubin follow-up, given the desire for divergence of the two telescopes. Chris Davis responded that though this is being considered by the Gemini Board, a determination has not yet been made on that front.

The activities of some observatories have been impacted by COVID and other social issues. By late summer, observatories in high-risk locations shuttered, following precautions to ensure the health and safety of staff, while simultaneously ensuring the necessary maintenance of infrastructure. DESI was commissioned just before the lockdown, but its transition to operations to begin the five-year DESI survey is pending return to normal operations. Steps have been taken - in partnership with the Department of Energy and NASA - to ensure that DESI and NEID can be brought online smoothly once things resume.

Priyamvada Natarajan asked if there is a plan in the future to have a seamless mega archive with either open access or "as-per rules" in terms of proprietary time. Pat McCarthy responded that focus presently is on ensuring we have big survey data, big catalogues, and seamless interfaces. However, consideration is being given to the mechanism and structure for ground-based data that is analogous to the master archive, which is primarily space based. He noted that this is an area for further evaluation as NOIRLab continues

to build out its vision for the future.

John O'Meara highlighted the need for data discovery and interoperability between the telescopes, with uniformity in meta data between the various facilities. Pat McCarthy agreed, and noted that with Rubin coming, it is essential that all parties are set up in a manner that allows for maximization of the database.

Diversity, Equity and Inclusion (DEI)

Julie Carruthers spoke about diversity, equity and inclusion efforts at the DOE. The Office of Science at the DOE has responsibility for ten of the national laboratories, and over the past four years, has moved from a compliance-based approach for monitoring DEI activities within laboratories, to an oversight process that requires actionable strategies, that are reviewed on an annual basis. In 2019, an external peer review of the laboratories' efforts was undertaken. Efforts are underway to address the recommendations from the review.

In the past year, DEI initiatives have been expanded to include an internal assessment of the Office of Science business practices. An internal working group with representation across all research program offices was struck, and a systematic review of business practices undertaken. This resulted in a slate of fifteen recommendations, that have since been shared throughout the Office of Science. A more proactive approach has been taken to communicating the DOE's commitment to DEI, including working collaboratively with the DOE Office of Civil Rights as well as other groups such as the White House Subcommittee on Safe and Inclusive Research Environments.

Harshal Gupta provided an overview of DEI initiatives within AST, MPS and NSF. Diversity has long been a priority at NSF. The BPWG, for example, has a multitude of programs designed to broaden the participation of underrepresented minorities. There is a recognition that transformative change requires attention to equity and inclusion. AST has chartered a Diversity, Equity and Inclusion Task Force that will:

- Take stock of AST/NSF programs and awardee efforts.
- Assess effectiveness of programs and initiatives through community outreach and input, as well as internal evaluations.
- Recommend new programs and/or changes to existing programs.

The AAAC is a tremendous asset and plays a valuable role in articulating community priorities. Harsha Gupta noted that the best ideas come from the community, and NSF has the mechanisms to stimulate those ideas, and a long history of helping to support them.

Steve Shi shared highlights of NASA initiatives on diversity and EEO. The agency takes an approach that seeks to identify and reinforce the causal link between diversity and equal opportunity, to safety and mission assurance. Over the past three years, there have been several campaigns aimed at addressing various social issues through education, training and quick, proactive response to complaints. Last September, the Unity Campaign was launched to elevate diversity efforts to also focus on equality and inclusion. Since then, NASA has added inclusion as a core value and issued three new workforce policy statements on diversity, EOO and anti-harassment. Work is underway to add new performance requirements for Unity in SES performance plans, and to integrate orientation programs for onboarding employees to make them aware of the entire universe of diversity at NASA. In the wake of racial violence against African Americans and the subsequent civil unrest and protest, NASA mobilized, through the Unity program to bring employees together with trained, professional facilitators to engage in diversity dialogues to provide support and foster mutual understanding. NASA also takes an external civil rights compliance-based approach to its grant administration programs.

John O'Meara acknowledged some of the great work being done by the agencies. The dual anonymous peer review at NASA, as well as the move by Astrophysics and Planetary within NASA to encourage and

support mission participation for traditionally underrepresented groups were highlighted. Despite the progress to-date, there is still much more to be done. He noted for example, that there was a noticeable lack of uniformity across the agencies with regards to issues of bias and proposals; and spoke to the absence of representative voices among people leading missions and projects on the ground. Critical interface between academia and industry typically takes place at this level, and therefore there is a need for greater efforts by the agencies to foster increased representation of black, indigenous and LGBTQ peoples at these levels. Priyamvada Natarajan added that diversity audits are needed to establish a baseline, identify barriers, and assess existing programs and initiatives to identify where there may be gaps. She also spoke to the issue of equality of opportunity within astronomy, and other scientific communities. Eliza Kempton suggested that improved coordination between the agencies could potentially generate better data, which leads to improved assessment of initiatives and outcomes. Julie Carruthers pointed out that existing laws, and general reluctance for people to provide demographic data, pose significant challenges to data collection efforts.

The Chair indicated that conversations around DEI would continue to take place at the committee. Going forward presentations from Paul, Kathy and Ralph (or their designates) would be requested to include a DEI lens. This will be especially important with the Astro2020 recommendations around the state of the profession become available.

Report from the Decadal Assessment of Plasma Science

Gary Zank reported on the decadal assessment of plasma science. As part of the Physics 2020 Decadal assessment, NASEM conducted a study of past progress and future promise of plasma science and technology and provided recommendations. This included an assessment of whether present plasma science workforce and training opportunities are commensurate with future workforce needs. He noted that the committee was restricted from altering recommendations from the Decadal Strategy for Solar and Space Physics.

In its examination of diversity, equity and inclusion in Plasma Science & Engineering (PSE), the committee found that there was a lack of diversity in the core areas of PSE. With the expected turnover in the workforce within the next decade, there is an opportunity to improve diversity in PSE, and the committee strongly endorsed the importance of, and efforts to diversify PSE.

There is a need to fully exploit the interdisciplinary and multi-disciplinary potential of PSE in terms of fundamental research and the translational research it enables. Agencies directly supporting PSE can accomplish this through greater engagement with other federal agencies and improved coordination of activities. Federal agencies and programs focused on fundamental research should join with agencies that utilize plasmas in science and technology to try and develop coordinated activities. For example, DOE-FES, DOE-NNSA, NASA and NSF can explore collaborative opportunities and leverage their resources in fundamental research in space and astrophysical plasmas for advancing missions.

NSF, NASA and DOE each support some level of plasma astrophysics. While there is limited bi-agency coordination, there is currently no scientific or administrative tri-agency (or more) coordination of any activities in plasma astrophysics. This presents a significant leadership opportunity for NSF and the Astronomy and Astrophysics program.

The committee also found that there is a lack of critical mass of faculty in the PSE and posits that this will lead to an erosion of US capability in PSE. They recommended that federal agencies structure funding programs to provide leadership opportunities to university researchers in PSE, and to stimulate the hiring of university faculty. Andrew Connelly inquired whether the lack of critical mass of faculty and turnover in the field is occurring across the board, or in specific areas; as well as the reason for limited investment by universities into plasma physics. Mark Kushner responded that, unlike astronomy for example, there are no

departments of plasma physics. Instead, plasma physics investigators are spread throughout engineering and physical sciences departments. Unfortunately, where funding restrictions exist, hiring for minority specialties within departments can often be negatively impacted. Gary Zank added that plasma science funding as a discipline is also limited. Further, the balkanization of the field is due in part to its success and applicability to a wide range of other disciplines, but it is also a reflection of the nature of the funding process.

Discussion on Preparations for the Astro2020 Report

Paul Hertz provided an update on the NASA astrophysics decadal survey planning, noting that the survey will provide guidance on what the next large mission or flagship should be, among other recommendations. The goal for the survey is that it be ambitious and compelling, leading to paradigm shifting discoveries about the universe, and encouraging stakeholder support. NASA has engaged in a series of large and medium mission concept studies, white papers, and other planning activities to inform the work of the Decadal Survey Committee.

Currently, the panel work is mostly complete, with only the State of the Profession Panel still completing outstanding work. The Steering Committee had its final public meeting on August 25th and a Spring 2021 delivery date was announced for the Decadal Survey Report. In preparation for Astro2020 implementation, NASA has developed an internal study team led by three astrophysics program managers to develop options for managing technology development and pre-formulation studies following Astro2020 report. Separately, the division is also conducting internal planning for possible non-mission recommendations. Astrophysics has been holding a ~$50-100M annual wedge starting in FY23 to respond to Astro2020 recommendations.

Kathy Turner spoke about the DOE HEP cosmic frontier, and the potential impacts of Astro2020 for the agency. Guidance from Astro2020 will inform HEP on compelling, high-impact opportunities in alignment with the science priorities and capabilities of the HEP community. HEP is keen on collaborative partnerships with NASA, NSF and other agencies, as appropriate, to optimize and leverage funds and community expertise.

HEP is moving forward on CMB-S4, which is also being proposed to Astro2020 as a partnership of DOE-HEP and NSF-AST/PHY/OPP. Several years ago, DOE started cosmic vision groups in dark energy and dark matter and is now seeking new opportunities in these areas. To that end, science ideas for enhancing and going beyond DESI and LSST are being proposed to Astro2020.

Ralph Gaume noted that there have been broad discussions and planning within the Foundation for the Astronomy Decadal. Regarding NSF identification of ngVLA or the extremely large telescopes, Ralph Gaume noted that Congress has made its will be known very explicitly in this regard. At the direction of the Appropriations Committee NSF has been advised each year to provide funding and development funding for some of the large-scale projects that may come out of the decadal and has been directed to provide this funding over the coming year.

The Chair asked the committee about lessons learned from Astro2010 or Astro2000 that have been accounted for in the planning and preparation for Astro2020. Paul Hertz indicated that NASA has established a large mission study team to examine lessons learned from large missions over the year, and to bring forward a report which will be used to guide and inform the science going forward. In addition, consideration has been giving to issues such as early technological investments, pre-formulation work, manufacturer capabilities, integration, and testing. This early work significantly reduces risks related to cost and schedule and is taking place parallel to ongoing planning inside astrophysics. Ralph Gaume expressed agreement with the importance of risk reduction strategies and noted the importance of

partnerships and design process on the ground as lessons learned.

Status of Rubin Construction, Data Management and Partnerships

Edward Ajhar provided an update on Vera C. Rubin Observatory activities. The Rubin project, including operations, is managed through a Memorandum of Understanding (MOU) between NSF and DOE. Construction funding for the observatory is as follows: $473M for telescope and site facility by NSF; $168M for camera fabrication by DOE; and an additional $30M for primary/tertiary mirror and secondary mirror blanks from private, corporate, and institutional donors.

Rubin Observatory will conduct a ten-year survey of billions of objects in space and time. The telescope has an f/1.2, 8.4-meter primary mirror with a field-of-view of 3.5 degrees (9.6 square degrees). The camera is 3.2 gigapixel, with a two-second readout, that will produce about 20 terabytes of data per night. Each point in the sky will have 825 visits (main survey: 18, 000 square degrees), with *ugrizy* filters. At its peak Rubin will produce about 10 million alerts per night, with a 60-second latency. The original schedule had the survey starting in FY 2023; however, that has been delayed due to COVID-19.

The design of the observatory and its components were driven by dark matter, dark energy, Milky Way structure and formation, cataloging of the Solar System, and exploration of the transient sky. Construction progress has been impacted by COVID-19. As of June 2020, 83% of the construction has been completed, with a cost performance index of 0.98 and a schedule performance index of 0.99. Dome completion is anticipated at about 11 months after the restart of site activity. Telescope Mount Assembly (TMA) completion is anticipated about 9 months after the restart of the site. An operations rehearsal was conducted using the Commissioning Camera (ComCam) deployed in La Serena, on 2020 July 28–30. Calibration images were acquired, and the data transferred to NCSA and ingested to data repositories. Quality Assurance was performed using science pipeline tools.

The annual NSF-DOE Joint Oversight Group (JOG) held a Joint Status Review via Zoom meeting August 31 to September 4. A comprehensive review of all aspects of construction and commissioning status was conducted, including the transition to operations. There was an additional focus on the camera key performance parameters, which are expected to be met before the camera is delivered. A review of safety protocols with an emphasis on COVID-19 was also completed. The final panel review report was recently submitted with a highly positive outcome for the project.

COVID-19 impacts

The Pachon Site was shuttered, March 20, 2020.

Post-shutdown activities have included Summit site visits for inspection and essential maintenance of critical equipment.

Currently, NSF expects a delay of 9-12 months, but COVID-19 impacts remain a moving target.

AURA is beginning its next phase of restart activity planning.

SLAC began a phased restart of camera activity in mid-May.

Funding and replanning are coordinated among NSF, DOE, and project management.

A restart of telescope mount assembly work is expected by January.

As it relates to risk management, NSF does not allow contingency use for unforeseeable risks, such as the

impacts of the COVID-19 pandemic. NSF policy allows Management Reserve to cover such risks. Any increase in TPC of more than $10M for construction will require NSB approval. The management team is tightly coordinating the replanning of construction and operations.

The JOG is moving to about a 1:1 ratio for operations funding between NSF and DOE. The U.S. Data Facility (USDF) for Rubin is moving from NSF- to DOE-funded scope. This change aligns well with DOE's camera responsibility. DOE is in the final stages of finalizing details on the USDF selection process.

Forty-one Letters of Intent (LOIs) to propose contributions have been received from international teams for the Rubin international in-kind contribution program. Thirty-nine have been approved for further development. The Contribution Evaluation Committee is evaluating the LOIs and will provide homogeneous feedback to the proposing teams. The deadline for full proposals is September 25. The proposals will be reviewed by the Contribution Evaluation Committee, with recommendations on their acceptance by December 15. Rubin Management Board review and approval is expected early 2021.

John O'Meara asked about the purpose of the Interim Data Facility (IDF), specifically what data it will be serving. Bob Blum responded that the IDF will be used to train the operations team as well as provide opportunities for understanding and learning how to use data by the community. The initial data preview will be built around a simulated data set from the Dark Energy Science Collaboration called DC-2. Future previews are being planned with commissioning data, and those could be flexibly used in the IDF from ComCam.

Topics for Future Meetings/Any Other Business

The Chair noted that conversations on DEI were only the beginning and expressed a desire for the committee and agencies to have regular, ongoing dialogue to share updates on activities in this area. Suggestion that the next scheduled meeting with the agencies regarding DEI include a closed session to facilitate more fulsome conversation on high sensitivity issues; The Chair will investigate requirements for adding closed session to committee meetings. The Chair will be meeting with Jeff Hall and Connie Walker for discussion on satellite constellations; an update will be provided to the committee following the meeting. The impact of COVID-19 on the budgets of major facilities, as well as targeted funding for projects should be addressed at the next meeting.

MEETING ADJOURNED AT 3:00 PM, 22 SEPTEMBER 2020