

**Minutes of the Meeting of the
Astronomy and Astrophysics Advisory Committee
(AAAC)
18-19 January 2024**

Attendees:

Committee Members:

| | | |
|----------------|--------------------------|-----------------|
| Britt Lundgren | Wenda Cao | Sarah Horst |
| Ann Zabludoff | Michael McCarthy (chair) | Nikole Lewis |
| Darcy Barron | Alyson Brooks | Abigail Vieregg |
| Lucy Ziurys | Willie Rockward | Hee-Jong Seo |

Agency Personnel:

| | | |
|--------------------------------|----------------------------|-----------------------------|
| Carrie Black (NSF) | Zoran Ninkov (NSF) | Harshal Gupta (NSF) |
| R. Chris Smith (NSF) | Martin Still (NSF) | Donna O'Malley (NSF) |
| Dan Fabrycky (NSF) | James Neff (NSF) | Ashley Vanderley (NSF) |
| Jean Cottam Allen (NSF) | David Morris (NASA) | Carrie Kolar (NSF – Assoc.) |
| Allison Farrow (NSF) | Andreas Berlind (NSF) | Christopher Davis (NSF) |
| Joe Pesce (NSF) | Mark Clampin (NASA) | Terri Green (NSF) |
| Bryan Field (DOE) | Alinda Mashiku (NASA) | Kathy Turner (DOE) |
| Randy Phelps (NSF) | Terri Green (NSF) | Rhonda Davis (NSF) |
| Gwenaelle Dufour (NASA) | Helmut Marsiske (DOE) | Hans Krimm (NSF) |
| Joshua Reding (NSF) | Jonathan Williams (NSF) | Kelly Fast (NASA) |
| Brian Humensky (NASA) | Vyacheslav Lukin (NSF) | Bob Cosgrove (NSF) |
| Derrick Hampton (NSF – Assoc.) | Valerie Connaughton (NASA) | |

Others:

| | | |
|------------------|-----------------------|------------------|
| David Gaba | Brian Harvey | Nicholas White |
| Francesco Bordi | Caitlin Schrein | Connie Walker |
| Nigel Sharp | Vivian O'Dell | Patricia Mahoney |
| Denis Feerick | Jennifer Andrews | James Kennea |
| James Strait | James Lochner | Zoe Wai |
| James Murday | Vladimir Papitashvili | Kelsey Krafton |
| Griffin Reinecke | Francesco Bordi | Richard Rogers |
| Nick Konidaris | Jean Toal Eisen | Iamont Di Biasi |

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Day 1 of AAAC Meeting

18 JANUARY 2024

9:44AM – Welcome and Opening Remarks

Dr. Carrie Black (NSF) welcomes everyone. She reviews conflicts of interest for the committee members, as well as the Hatch Act and Anti-Lobbying Act. Black discusses the roles and importance of FACA committees and goes over their procedures. She states that the purpose of the meeting is to hear presentations from the three agencies and others and use them to discuss potential areas of cooperation as well as formulate recommendations for further cooperation, according to the mission in the AAAC charter. She briefly reviews charter duties for committee members, then turns the meeting over to the AAAC Chair, Michael McCarthy

Michael McCarthy gives welcome remarks, and notes that as this is the January meeting of the AAAC, it is the committee members' last chance to ask questions to and get information from the agencies before the committee writes the report. He reviews a proposed timeline for the report writing, saying that they want a fairly complete draft before the February 23rd meeting of the AAAC, and reminds the committee that they are required by law to present the final report by March 15th.

There is a round of introductions, and McCarthy asks for any further questions. There are no questions, so the committee moves on to the first presentation.

10:08AM – NSF Update, *Dr. R. Chris Smith, NSF Astronomy Division Director*

Dr. Chris Smith, the Interim Division Director of the Division of Astronomical Sciences at NSF, gives the NSF update presentation. Topics discussed include:

- The importance of the AAAC report for the agencies and the type of input that the agencies and readers are looking for from the AAAC. His suggestions include:
 - o How to make the report recommendations more impactful by ensuring they are concise, relevant to the agencies, and practical.
 - o That fewer recommendations have more impact than a long list, and that findings can be as impactful as recommendations.
- Review of what has been discussed in previous meetings, including:
 - o The results of the Laboratory Astrophysics Task Force
 - o The importance of developing ideas for “new approaches or programs,” stating that he believes this is a cornerstone of the '23 – '24 cycle.

- Highlighting the importance of workforce development as a foundation of the profession.
- Emphasizing the NSF's LEAPS, PAARE, ASCEND, and GRANTED programs as very important to the development of the field.
- Sustainable Astronomy and the progress that has been made in this area. Specific projects mentioned include:
 - Solar panels at NRAC
 - PV systems at Simons Observatory
 - The work of NOIRLab and Inger Jorgensen, their Chief Sustainability Officer
 - Goal of Gemini South being carbon neutral
 - Goal for Rubin to go 50-60% local energy
- Sustainable Ground and Space Observatory
 - NSF's ESM efforts (electromagnetic spectrum)
- Discussion of satellite pollution mitigation strategies, partnerships, and efforts
- The development of the Data Foundation
 - Builds on reports from two workshops this year
 - NSF is working with Simonyi and Simons Foundation in this effort
- Review of the development of the big-ticket Major Facilities recommendations of Astro2020
 - US ELT entered Preliminary Design
 - ngVLA entered Conceptual Design
 - CMB-S4 is pending entry to the Design Phase, but there have been challenges at the South Pole regarding infrastructure. Smith states that they are working hard to reset the infrastructure plan.
- Review of the phases of the Design Stage at NSF, emphasizing that entry into the Design Stage is not a commitment to fund the facilities
- Smith emphasizes that the AAAC report goes to the NSF Director and asks members to keep in mind that Directors must balance the needs of astronomy with other fields that have major facilities in these stages as well. He recommends trying to find a way to resonate with the challenges the readers (Directors, Congress) are facing.

Q&A Session

The Q&A session after Director Smith's presentation included the following topics:

- The carbon footprint efforts in NOIRLab
- How the committee can keep the challenges of readers in mind
- Sustainability in data processing

- Finding “new approaches and new programs” in the constrained funding environment

10:32AM – DOE Update, *Dr. Kathy Turner, Department of Energy, Office of High-Energy Physics*

Dr. Kathy Turner (DOE) gives the DOE update in a presentation entitled “Cosmic Frontier Experimental Program Update/Report to the AAAC.” Presentation topics include:

- The new management in Cosmic Frontier. It has a new program manager, and they are breaking the program into four sections:
 - o Cosmology Research
 - o Dark Matter Research
 - o Operations/Projects
 - o Others
- The P5 Report from the HEPAP subpanel, including overview and recommendations. Specifically, that:
 - o The report includes three science themes and two focus areas within each theme
 - o The highest priority was given to executing projects begun in the last decade, including includes HL-LHC, DUNE, and the Rubin Observatory
 - o There were six recommendations in the P5. Dr. Turner reviews the first three:
 - 1 – executing the current program (complete existing construction projects and support operations)
 - 2 – construct portfolio of major projects, in the following order: CMB-S4, re-envisioned second phase of DUNE, off-shore Higgs factory, ultimate Generation 3 (G3) dark matter direct detection experiment, Ice Cube-2
 - 3 – improve balance between small-, medium-, and large-scale projects. Includes a new small-project portfolio at DOE, Advancing Science and Technology through Agile Experiments (ASTAE).
- Suggestions and requests for the AAAC report recommendations, specifically:
 - o To remember that Cosmic Frontier is a subprogram
 - o It will help to have a few, focused recommendations
 - o To look for any gaps in the program and how we coordinate
 - o Note that in DOE specifically, it will not be useful to recommend more money
- The strategic plan for HEP/CF. Turner says that HEP/CE is currently following the 2014 P5 strategic plan, as it will take some time to digest the 2023 P5 and align with

its recommendations and plan. She reviews the currently strategic plan, giving specific updates on:

- Cosmic Acceleration - Gives updates on multiple projects, including DESI, LSST, SPT-3G, CMB-S4, LuSEE-Night
- Rubin - Held a town hall in January 2024
- Dark Energy Survey (DES) - Presented findings in January, notes findings of approx. 1500 new redshift-type Ia supernovae
- Reviews developments for the Rubin Observatory (the flagship project in HEP/CF). Specifically:
 - That the Camera is in testing phase – they’re making sure everything works before it’s shipped to Chile this spring.
 - Reviews the timeline for the Rubin Observatory
- Gives update on Dark Matter in Cosmic Frontier, including the big projects, indirect searches, and Dark Matter New Initiative concepts that are being developed.
- Quick review of clean energy in DOE. Turner notes that DOE has multiple initiatives regarding clean energy, but the AAAC may need to get someone from a different office to come and give a full update. She says that she will look into that.
- Review of the DEI and workforce development plans in place at DOE
- Review of the Budgetary estimates for HEP (dependent on a federal budget)
- In summary, Turner notes that HEP continues to carry out the 2014 P5 strategic plan, and future guidance will be provided by the 2023 P5. Turner notes again that will take DOE some time to digest and implement P5.

Q&A Session

The topics discussed in the Q&A session after Dr. Turner’s presentation include:

- Supporting individuals studying dark matter through ground-based telescopes
- Shifting from earth-based experiments to looking into space to answer questions in the latest P5

10:58AM – NASA Update, *Dr. Mark Clampin, Director, Astrophysics Division, Science Mission Directorate, NASA*

Dr. Mark Clampin, Director of the Astrophysics Division at NASA, gives the NASA update presentation. Highlights and topics discussed include:

- The Webb telescope discovered a “cat’s tail” of dust disks from Beta Pictoris (shared pictures)
- Martin Weisskopf and Paolo Soffitta and the IXPE team won the Bruno Rossi Prize

- An update on the Nancy Grace Roman Space Telescope
 - o It is staying within cost and schedule moving toward the 2027 launch
 - o Shows pictures and images
 - o Gives updates on the Wide-Field Instrument, Coronagraph Instrument, Telescope, and Spacecraft Bus – all in the development process
- An update on XRISM
 - o Launched on Sept. 6th, 2023
 - o The first science results/observations are being worked on
 - o There was one issue – the beryllium disk aperture door hasn't been able to open so far. The Japanese are working to open the door, but door issue means that it requires longer exposures to get what they need.
 - o It is producing excellent data, but the soft x-ray spectrum will be a problem because of the door.
- An update on GUSTO
 - o Balloon mission launched Dec. 31, 2023
 - o Spectroscopic terahertz observatory
 - o Explores cosmic ecosystems
- An update on SPHEREx
 - o The SPHEREx photon shields completed vibration testing (Director Clampin notes that this was nerve-wracking)
 - o The System Integration Review was completed on Nov. 16, 2023
 - o Notes that over its 2-year mission, it will collect data on approx. 3×10^8 galaxies
- An update on TDAMM (Time Domain and Multi-Messenger Astronomy) at NASA, specifically citing that a key goal is being able to get communications very quickly, but low-orbit satellites for commercial purposes makes that difficult. Director Clampin notes that the AAAC could help in this circumstance.
- Budget constraints as NASA, specifically:
 - o That Director Clampin has had to make hard decisions because of budget constraints, and is currently focused on maintaining a balanced portfolio
 - o The difficult situation they're in because of the flat budget (Director Clampin shows a chart modeling this, describing it as “between a rock and a hard place”)
 - o That investing in the Habitable Worlds Observatory is a major goal, even in the current budgetary circumstances – they're moving forward quickly, and it's essential to maintain US leadership in space exploration and astronomy
 - o Because of the budgetary constraints, they're making some reductions to the support of CHANDRA and Hubble

- Director Clampin notes that NASA does a lot of investment in technology, but people don't think of NASA as a technology development house. There needs to be recognition that NASA is responsible for developments and breakthroughs.

Q&A Session

The topics discussed in the Q&A session after Director Clampin's presentation include:

- Reduction of support for Hubble and CHANDRA
- Technology development at NASA, particularly in quantum and AI
- Low-earth orbit difficulties in NASA missions due to satellites

11:33AM – World Radiocommunications Conference 2023 Outcomes for Astronomy, *Dr. Jonathan Williams (NSF Electromagnetic Spectrum Management)*

Dr. Jonathan Williams (NSF) gives an update on the recent World Radio Communication Conference (WRC-23) in Dubai, discussing the conference background, outcomes, and science highlights. Specific items include:

- The background of the International Telecommunication Union (ITU) and WRC
 - o The International Telecommunication Union is part of the UN, and:
 - Organizes how the electromagnetic spectrum (EMS) is used
 - Maintains the International Radio Regulations treaty
 - Holds a conference every 4 years
 - Includes 193 member states and over 700 private entities
 - Maintains a table of frequency allocation (showing which spectrums within the EMS are allotted to what use)
 - o The ITU produces resolutions, recommendations, reports, handbooks, and bilateral/multilateral agreements between states, regional groups, and member organizations
 - Gives an example of ITU-R reports and bilateral/multilateral agreements
 - Notes that each nation has sovereignty over the use of the electromagnetic spectrum within its borders
 - The US government works with the ITU through the State Department at the highest level, then through the NTIA and FCC.
 - Radio astronomy is one of the allocation groups (groups who are allotted certain spectrums within the EMS)

- The design and outcomes of the World Radiocommunication Conference 2023 (WRC-2023)
 - o The conference was in Dubai and lasted 6 weeks. There were 4000 attendees, including 170 from the US delegation.
 - o The outcomes of the conference were positive, with Williams saying, “we pretty much got what we asked for.” Specifically:
 - Proposal for a database for radio quiet zones - Approved
 - Proposal for a database for space weather detectors – Not Approved
 - A proposal for space sustainability – Approved
 - o The science highlights of the conference, which include:
 - There was a worldwide effort to support science
 - WRC-23 was the most successful WRC for science in more than a decade
 - There were more than 620 pages of modifications to the International Radio Regulations
- The agenda of the 2027 WRC conference
 - o Williams highlights two items of particular interest, which are:
 - 1) Radio Quiet Zones
 - Williams reviews the bands under consideration, and which are most important to the U.S.
 - 2) The potential protection of frequency bands above 76GHz
 - o Reviews WRC-27 Study Cycle timeline
 - The agenda items will be worked on in groups over the next four years to prepare for the WRC-27 meeting
 - o Notes that many items on the 2027 agenda potentially impact science applications, so there will be massively increased demands for personnel and time to prepare for the 2027 conference.

Q&A Session

The Q&A session after Dr. Williams’ presentation covered the following topics:

- If Antarctica is a radio quiet zone, and how spectrum management there is governed
- How the ITU deals with overlap between neighboring countries
- Whether the moon is a Quiet Zone
- How conflicting goals and regulations are dealt with by NSF when they deal with other countries
- ALMA concerns and potential issues because of the number of satellites going up
- Whether optical communications are an ITU concern

- The need to bring more people into this field, as the complications will only increase

BREAK FOR LUNCH

The meeting reconvenes, and Dan Fabrycky notes that he is taking over the Designated Federal Official role for Carrie Black for the afternoon.

1:15PM – WoU/TDAMM Update, *Dr. Jennifer Andrews, NOIRLab*

Dr. Jennifer Andrews gives a presentation on the Windows on the Universe Workshop: Establishing the Infrastructure for a Collaborative Multi-Messenger Ecosystem, and its resulting white paper. Topics from the presentation include:

- The logistics of the workshop: it was held in Tucson, AZ in Oct. 2023. There were 100 in-person participants, and many more online
- The structure of the workshop, which consisted of panels followed by breakout sessions to discuss the panel topics, then reconvening to share the breakout conclusions
- The workshop topics and agenda, including:
 - o Day 1 of the workshop: Challenges and Community Building
 - Discussed events of 2017
 - Notes that there are many types of messengers, so the field will have to coordinate across messenger types, across the globe, and within different career stages
 - Discussion of “What is an astronomer”
 - o Day 2: Infrastructure Solutions: Software, People, and Funding
 - Discussed need to focus on workforce training and retention, interoperability, and long-term support
 - o Day 3: Ensuring the Future of MMA: Ensuring Multi-Wavelength, Multi-Messenger Coverage, Instrumentation, and Funding
 - Discussion of the need for long-term support to train and retain people
 - What MMA/TDA needs re: support and funding is software, hardware, and people
- Review of the white paper recommendations, which were divided into Hardware, Software, and People and Policy, with separate recommendations for the funding agencies and the community at large. These included:
 - o High-level takeaways:
 - Need to retain software engineers

- Public facility needs to equal public access, which needs to equal public data (public facility = public access = public data)
 - Urgently need a replacement for SWIFT
- Hardware recommendation highlights:
 - Need wide-field imaging from the ground, as Rubin won't meet the whole demand. The smaller options (ZTF, ATLAS, ASASSN, etc.) need support
 - Follow-up spectroscopy from the ground is essential, and requires significant investment in new community-accessible optical/NIR spectroscopy
 - Continued support for next-generation VLA and for Very High Energy Gamma ray detectors, as well as continued sensitivity improvement in ground-based Gravitational Wave detectors and high-energy neutrino detectors.
 - To NASA, specifically, there absolutely needs to be a replacement for SWIFT (and the replacement must have the agility of SWIFT)
 - Winding own the TDRSS may leave a gap in the communications infrastructure required by MMA/TDA
- Software recommendation highlights:
 - All the hardware needs software
 - Significant opportunity for MMA/TDA software
 - Software is under-resourced by funding agencies and undervalued by the community as a whole
 - Need a whole suite of software to handle the unique challenges of coordination and follow-up
 - Came up with a phased approach (3 phases) for software development (notes sustained funding is crucial)
 - Funding agencies should require observatories to provide pipelines for processing data
- People and Policy recommendation highlights:
 - Implement DEI initiatives through Astronomy as a whole
 - Need funding channels with industry-competitive salaries
 - Need to weight software more heavily in tenure evaluation, fellowships, funding, etc.
 - Data from public facilities must be public with easy community access (she shares ideas for implementing this)
- Four specific suggestions for NSF and NASA:

- 1) joint NSF/NASA software development can reduce duplication of effort
- 2) Dedicated MMA/TDA archive infrastructure that has data from BOTH space and ground-based observatories
- 3) NSF and NASA should develop a coordinated policy that supports future MMA/TDA space mission proposals observing time requirements
- 4) support existing efforts to enable MMA/TDA science at NASA and NSF
- Specific suggestions for NASA
 - Many people at the workshop urged NASA to rapidly develop an implementation plan for the highest priority sustaining capability for space identified in the 2020 Decadal Survey
 - Urges NASA to follow the Decadal, which prioritized MMA/TDA
- Final comments:
 - Democratize access to the study of MMA/TDA by making the facilities public
 - Closer coordination between NASA and the NSF is a necessity, particularly in long-term planning

Q&A Session

Topics discussed in the Q&A session following Dr. Andrews' presentation include:

- Which recommendations to prioritize given a restricted budget environment
- Splicing together the different messengers (neutrinos, gravitational waves, etc.)
- The need for software engineers in the field
- How ready people are to do the follow-ups for Rubin, and access to Rubin for MMA/TDA
- The correct acronym (MMA/TDA vs. TDAMM)
- TRSS winding down
- How the community can coordinate infrastructure and software to avoid redundancies, and who oversees this coordination in the agencies

FIVE MINUTE BREAK

2:30PM – Committee Discussion/Report Planning

Mike McCarthy suggests they spend the time discussing how they want to format the report and the topics they want to cover – specifically, what are the most important interagency

topics. He suggests splitting the recommendations in two, so Section 1 will be Interagency Cooperation Recommendations, and Section 2 will be Decadal Survey Recommendations.

Abigail Vieregg suggests TDAMM and workforce development, saying that there's a critical need to retain software engineers. Chris Smith notes that if astronomy is losing people to industry, they are contributing to the larger skilled workforce. McCarthy says that talking about how astronomy at NASA and NSF is acting as a broader workforce development and technology development pathway would be a way to get bigger and better buy-in beyond the bounds of astronomy. Discussion of astronomy career paths follows.

Chris Smith discusses prioritization and shares the link to the MPSAC Facilities Subcommittee 2nd Report (about how to approach prioritizing projects) in chat. A discussion of the Facilities report follows. Smith encourages everyone to look at the report and think about how the committee can respond to and incorporate it in the AAAC report (for example, how does our prioritization in the AAAC report fit within the larger Facilities report concepts).

Mike McCarthy further suggests laboratory astrophysics and data as topics to discuss in the report, noting that even a modest investment in lab astrophysics would have outsized returns, making it low-hanging fruit. Britt Lundgren asks if Rubin has the capacity to house both ground- and space-based data, and says that if it doesn't, that would be a high priority.

McCarthy also suggests Dark and Quiet Skies as a topic for the report, emphasizing what can be done so that the new facilities being recommended can reach their full potential. He also suggests demographic data gathering, as it is an ongoing issue. Abigail Vieregg suggests renewable energy at the South Pole and sustainability as topics, and Britt Lundgren asks if sustainability and carbon footprint could be tied together in the Decadal response.

McCarthy lists potential topics so far: technologically advanced workforce, TDAMM, lab astro, workforce development, demographic data. He says that the committee should try to identify the high-priority things and focus on them, selecting no more than five. He then reviews his vision for the report structure, and Britt Lundgren suggests using Jennifer Andrews' breakdown of Hardware, Software, People and Policy in the report.

Connie Walker suggests Dark and Quiet Skies as a topic, protecting skies from interference from satellites.

Mike notes that for major facilities, to ask for something big in a flat budget, the committee needs to look like it has its own house in order and has done the work to make the request reasonable.

Lundgren and McCarthy discuss shutting down old facilities to make way for new ones, and McCarthy asks whether Facilities are moving out of Division decisions and to NSF as a whole. Chris Smith says that the question has been discussed and is evolving, but no solution has been reached (yet). Discussions of costs and lifecycle of major facilities, with Jim Neff noting that astronomy can't happen without these facilities (observatories). McCarthy stresses that the facilities need to have a wider benefit to the community, and that needs to be highlighted in the report.

20 MINUTE BREAK

4:00PM – Task Force on Laboratory Astrophysics, *Dr. Lucy Ziurys, LATF Chair*

Dr. Lucy Ziurys provides an update on the Task Force for Laboratory Astrophysics preliminary report. Topics discussed include:

- The structure of the Task Force, which is broken into three groups:
 - o ISM
 - o Planets and Exoplanets (PIEx)
 - o Stellar, Nuclear, and Plasma
- The purpose of the Task Force: to survey the state of lab astrophysics, identify needs, identify national resources for those needs, and consider new programs/approaches for databases
- How the Task Force developed its findings: they undertook many meetings, two surveys, and lots of research and discussion to get to this point. Ziurys notes that the hard work of the task force is almost done.
- The results of the Survey:
 - o Positive Results:
 - There are current lab astrophysics facilities and databases, and funding does exist, particularly in physics and chemistry departments
 - o Needs Improvement Results
 - The lab astrophysics workforce is below critical mass and aging
 - Funding sources are limited
 - Databases aren't maintained and updated
 - Large-scale observatories and missions have no Lab Astrophysics funding
 - There are many areas of missing or low-quality data
- Recommendations to both the community and large and to the funding agencies
 - o Community at large:
 - Need focused workshops

- Need to support and standardize databases
 - Need more hiring at junior level at universities in Lab Astrophysics
 - Develop a shared component to many existing lab astrophysics facilities
- Funding Agencies:
 - More lab astrophysics funding
 - Workforce development focus
 - Long-term financial support of databases
 - Funding for Lab Astrophysics re: missions and telescopes
 - More funding opportunities (grants, etc.)
 - There needs to be support for collaborative efforts between experimental, theoretical, and observational astronomy (cut between the siloes)
- The findings of the three subgroups
 - ICM:
 - Positive:
 - There is both atomic and molecular data, which has led to significant ISM-related discoveries
 - ISM-related lab astrophysics research plays a big role in workforce development for astrophysics, applies to broader STEM workforce
 - Needs Improvement:
 - Major need for curation and standardization of ISM-relevant data
 - The past 3 Decadals have recommended funding increases for laboratory astrophysics grant programs, but that has not materialized. Average sizes and numbers of awards in this area have remained flat.
 - Lab astrophysics is not involved in mission planning, which is going to hurt astronomy in the long-term.
 - Reviews ICM recommendations for the community at large and to the funding agencies
 - Stellar, Nuclear, and Plasma Astrophysics
 - Positive:
 - Have experienced researchers and facilities, and the user community expressed a strong need for Lab Astrophysics data
 - Needs Improvement:

- The aging workforce is seriously going to hamper the science
 - Reviews recommendations to the community at large and the funding agencies.
- Planets and Exoplanets (PIEx)
 - Reviews subgroup's findings in Needs, Status, Databases, and Funding: funding, databases, and facilities are limited
 - Ziurys notes that the habitability of exoplanets is of significant interest socially and politically
 - Recommendations: shared facilities, dedicated funding calls, database support, and cross-disciplinary meetings
- Ziurys highlights the excellent work the LATF members did and thanks them

Q&A Session

In the Q&A session after the Laboratory Astrophysics Task Force update, the following topics were discussed:

- The timeline of the report, and how it fits into the AAAC report
- The budgetary outlook for the funding agencies
- The need for innovative ideas for using the resources we have more effectively
- How to encourage lab astrophysics and make it exciting
- Funding and career paths for the lab astrophysics field
- The need for demographic data for the lab astrophysics population
- Maintenance for databases and what that involves and requires
- The potential of interagency cooperation on laboratory astrophysics funding
- The potential for and challenges of moving towards a shared facility model in lab astrophysics
- Alternative funding options for laboratory astrophysics
- Discussion of taking some of the money for observatories like ALMA and putting it aside for lab astrophysics studies – what that would look like, the feasibility, and where the money would come from

Discussion of weather contingencies and planning for the next day.

Day 1 of the AAAC meeting ends at 5:15pm.

Day 2 of the AAAC Meeting

19 January 2024

9:30AM – Call to Order

The meeting reconvenes at 9:30 in the morning. Carrie Black gives a quick overview of the plan and schedule for the day. The committee reviews and discusses the new internal site for the AAAC, making suggestions for items to add or improve. The committee then discusses the dates for the AAAC meetings for the rest of the calendar year, including a discussion of how long current member's terms last and how that aligns with the changing meeting schedule. Allison Farrow requests that members fill out the Doodle poll that was sent out for the June and September 2024 meetings, and the committee is reminded that the next meeting is on February 23rd, and the report is due on March 15th.

9:45AM – Satellite Constellation and Collision Impacts on NASA Missions, *Dr. Alinda Mashiku, Conjunction Assessment and Collision Avoidance Group (CARA), NASA*

Dr. Alinda Mashiku gives a presentation on NASA's Conjunction Assessment and Collision Avoidance (CARA) program, entitled "NASA Conjunction Assessment Risk Analysis (CARA): CARA Overview, Large Constellations and Light Pollution." Her presentation includes:

- An overview of CARA, including:
 - o The history of Satellite Collision Avoidance Operations at NASA
 - o How the CARA program is responsible for risk assessment and mitigation for non-human spaceflight spacecraft
 - o The scope of the CARA program, which reduces operational risk for NASA by protecting missions from collisions for spacecraft safety and space environment protection
 - Protects approximately 100 NASA missions
 - Works with missions to put together an OCAP pre-launch and CAOIA
 - Once missions are launched, CARA provides real-time support for collision avoidance and risk management
 - o The composition of CARA, which is composed of five groups: orbital safety analysis, operations team, analysis team, software and ground systems and system administration, and management

- Who CARA interfaces with: FAA, FCC, DoC, CNES, Space Weather, NASA HQ, and commercial owners/operators, among many others
- The processes and procedures that CARA follows for protecting against collisions, including:
 - The Conjunction Assessment process, which is a three-step process that includes 1) Conjunction screening/assessment, 2) Risk analysis, and 3) Collision avoidance
 - Maneuver planning, including an overview of the maneuver planning process and timeline (Dr. Mashiku notes that maneuver planning is an iterative process, and the more data they get about a potential collision, the more likely issues are to be averted)
 - A snapshot of CARA's real-time process, which includes:
 - Screening (3x/day, every day)
 - TCA (the processes between conjunction identification and executing maneuvers – total length of time is 7 days)
 - Notes that CARA has 7-41 active interfaces and 7-25 total datasets transferred for EACH conjunction event
 - Notes that each satellite owner/operator is responsible for making maneuver designs and executing the maneuvers
 - Review of an example Summary Report CARA receives, with event flags in red, yellow, and green
 - Dr. Mashiku notes that there is no typical way to predict how a collision potential will trend, so CARA needs to monitor each potential event closely and cannot rely on modeling to prevent collisions
- Operational challenges with large constellations (Starlink, among others)
 - Very large effort to coordinate
 - Each owner/operator has their own level of CONOPS sophistication, or understanding of the importance of screenings and how they work. CARA works with large constellations as early as possible to understand their CA CONOPS.
 - When more satellites are launched, they must continue to support existing efforts at the same level, which means a huge effort and lots of coordination
 - Current on-orbit constellations that CARA is tracking include SpaceX Starlink, OneWeb, Flock, SpaceBee, and Lemur/Minas
 - The process of monitoring and what they track to make sure everything goes well
 - Shows bar plots showing the growth of constellations over the last 4 years – all have increased (Starlink the most)

- CARA conjunction statistics, which are generated monthly.
 - o Current statistics show 28,000 catalogues objects, and an increase in total conjunction events (including debris events, active payload events, large constellation events, etc.)
 - o Conjunction statistics are getting worse – CARA has a process, but the question looms of whether it’s sustainable
- The NASA-SpaceX agreement
 - o SAA codifies that Starlink will take all CA mitigation actions and that NASA will not maneuver without 24 hours’ notice
 - o Currently working on a replacement that removes the maneuver restrictions
- Reviews CARA’s operational cloud computing platform
 - o Moved to the cloud because it lets CARA scale and know they can continue supporting missions in real-time
 - o It’s been very helpful because it lets them track increasing conjunctions while minimizing the (still very significant) cost, maximizing efficiency
- The NASA Best Practices Handbook
 - o CARA shares the Best Practices Handbook with Owner/Operators to give them an understanding of best practices to protect the space environment and mission in low-earth orbit. It is available to the public.
 - o The Handbook gives examples of collision avoidance plan plots and shows the severity of the likelihood of conjunctions at different altitudes, helping owner/operators understand what kind of risk they’ll be facing and how small changes can help them mitigate this risk
- The concerns of the astronomical community regarding light pollution interfering with ground-based astronomy and how to minimize it
 - o There is a software tool that was created for the CARA team that gives a light pollution indicator that shows if light pollution is at acceptable levels for large constellations
 - o Gives an overview of constellation light pollution in the visible and near-infrared spectral bands (she will share a paper on this after her talk)
 - o Reviews how light pollution is measured and how to keep constellations/satellite brightness under the recommended line
 - o Reviews the Light Pollution Evaluation Indicator, a tool for owner/operators to see if their constellations meet requirements
- Summary:
 - o The orbital environment is rapidly growing
 - o CARA is a very complex organization that supports real-time and pre-real time missions, and the complexity will only increase with time

- There are currently no regulations on space traffic, so CARA relies on technical best practices
- The Office of Space Commerce is being set up as a regulatory body for the space community
- There are many factors to consider in the goal of keeping the space environment safe and achieving the desired science

Q&A Session

In the Q&A session following Dr. Mashiku's presentation, the following topics were discussed:

- The areas in orbit where potential events are maximal verses minimal, and strategies to help missions avoid high-risk areas
- Where the NASA telescopes are located and how NASA mitigates issues, specifically regarding Hubble
- The size of the sub-teams at CARA and if there are comparable oversight groups in other countries
- If there has been discussion of designating certain altitudes for certain purposes, given the projected growth in satellites
- That most satellites are much brighter than the recommended levels, and how to deal with that
- Whether CARA advises missions other than NASA's
- Sky brightness, and whether a final determination has been made on the topic

10:50AM – Planetary Defense Update, *Dr. Kelly Fast, Planetary Defense Coordination Office, NASA*

Dr. Kelly Fast gives a presentation on the “Impact of Satellite Constellations to Near-Earth Object Survey at NASA” covering the broader topic of satellite impact on planetary defense. Topics discussed in her presentation include:

- Planetary defense coordination, assessment, and mitigation at NASA
- The role of the Near-Earth Survey Telescopes as part of the planetary defense systems, including where they are located and what they do (includes NEOWISE, ATLAS, Catalina Sky Survey, Pan-STARS, LINEAR/SST)
- How telescopes work to get multiple-image sequences (using example from the Cataline Sky Survey)

- That most asteroids, including near-earth objects, are best found in the night sky, not at dawn/dusk when faint objects are difficult to detect
- That NEO surveys have been disentangling artificial from natural moving objects for a long time, so it's not a big issue for planetary defense (Dr. Fast describes it as "more of a nuisance")
- That a single streak doesn't ruin an entire image
- The impact to ground-based NEO survey by satellite constellations
 - o Little impact, it's business as usual at the moment; Dr. Fast doesn't say that it's not a concern in the future, but at this point in time she says it will just make people's jobs harder
- NASA launch of NEO Surveyor (launch planned for 2028)
 - o Will look for near-earth asteroids in the infrared from the Sun-Earth L1 point to complement ground telescopes looking at opposition and accelerate NEO discovery

Q&A Session

In the Q&A session following Dr. Fast's presentation, the following topics were discussed:

- Whether there is a point when the number of satellites will become a problem, and how big that problem will be
- The extent to which brightness makes it more of a nuisance
- Potential modeling of the impact if they missed a planetary-threat asteroid (very low likelihood, according to Dr. Fast. There is redundancy built into the process)
- Threat modeling
- The asteroid verification process
- Whether the NEO Surveyor will replace the need for ground-based surveys

11:15AM – Research Integrity and Workplace Policies at NSF, *Rhonda Davis (OECR), Bob Cosgrove (OECR/ACB)*

Rhonda Davis (Office of Equity and Civil Rights, NSF) and Bob Cosgrove (Office of Equity and Civil Rights – Awardee Compliance Branch) give a presentation on workplace policies and creating a safe working environment. Topics discussed include:

- Why it is important to have a safe working environment
- Which NSF offices are involved in addressing harassment, including:
 - o OECR – Office of Equity and Civil Rights
 - o Policy Office – responsible for developing and implementing

- Office of General Counsel
- Working Group
- How harassment incidents get reported to NSF
 - OECR is the designated office that handles this, but incidents can be reported via multiple emails/channels
 - NSF Policy: if any NSF staff learn of harassment incidents, they are required to report them to OECR.
 - Complaints can be filed by participants in NSF-funded programs
 - Complaints can be filed anonymously, but that limits NSF's ability to properly investigate the complaint
 - Davis shares a QR code that takes you to the OECR online complaint filing form so committee members can see it
- Title IX of the Education Amendments of 1972 and its use at NSF
 - Title IX is the source of the authority for NSF's harassment policies, and the Department of Education also has enforcement authority for Title IX through its Office for Civil Rights, and constitute most of the complaint investigation and resolution activity at NSF awardee organizations who may also receive funding from ED.
 - NSF's Title IX requirements and the process they go through if they receive a complaint
 - Notes that unremedied violations of Title IX found by NSF can result in revocation or withholding of all federal funding
 - Overview of Title IX Compliance Review, including the process for post-award compliance review and coordination with other agencies.
- NSF's Harassment Notification Terms and Conditions
 - Requires the Authorized Organization Representative (AOR) to notify NSF of any findings/determinations of administrative leave
- How NSF reviews and assesses harassment notifications and what they look for (4 factors) and how they proceed (3 possible decisions)
- OECR conference and travel proposals
 - Conferences are required to have a policy or code of conduct, a complaint process, and a clear and accessible means of reporting violations
 - The AOR for the proposal is responsible for certifying that the meeting organizer has a policy or code of conduct regarding harassment
- Reviews additional terms and conditions for:
 - Individual postdoctoral fellows
 - Small Business Innovation Research (SBIR) solutions
 - Residential Experiences for Undergraduates (REUs) solicitations

- Reviews Certification Regarding Safe and Inclusive Working Environment
- Reviews the requirements of the CHIPS and Science Act of 2022 regarding efforts to understand and combat professional harassment
 - o Discussion of how changes due to the CHIPS Act makes it possible to move forward on research misconduct and harassment on a federal level
- International engagement and outreach, and that as they are working to eliminate and mitigate harassment across NSF and at the federal level, they are getting outreach from international bodies wanted to duplicate or learn from their processes

Q&A Session

In the Q&A session following the OEER presentation, the following topics were discussed:

- How many times NSF has revoked an award in the last five years
- How OEER allows entities found to be out of compliance fix their issues, and how terms and conditions change
- The federal funding implications of violating Title IX
- The rights of the accused and whether the process can be misused by universities or individuals acting in bad faith
- The 90-day requirement for being removed from a grant, and how that can be impacted by Title IX investigations
- The Antarctic situation and protections for unique settings like Antarctica
- Cooperative agreements and how to operate in locations where Title IX does not apply

BREAK FOR LUNCH

The meeting reconvenes at 1:30pm.

1:44pm – Public Comment Period

The Public Comment Period begins at 1:44pm. There are no public comments.

1:45pm – Committee Writing Period

Mike McCarthy shares two documents with the committee containing preliminary assignments and a potential report outline. He gives an overview of the report outline and what can go into the different sections, noting that recommendations will fall into two

sections: High-Priority Interagency Topics and Decadal Recommendations. At this point in the discussion, High-Priority Interagency Topics include workforce development, TDAMM, Dark and Quiet Skies, and Laboratory Astrophysics.

McCarthy notes that for the report to be impactful it needs to be concise and direct. He also warns against being too prescriptive with implementation, and says that as a general recommendation, the committee should not assume the budget will increase now and for the foreseeable future. McCarthy recommends not suggesting what will have to be cut for the committee's recommendations to be implemented, but to be honest with themselves about the fiscal reality.

McCarthy suggests a writing timeline for the committee, requesting a draft of every topic in the report in a 2-week timeframe, then aiming for a full draft version by February 5th so that the committee has two weeks for all the members to review the draft. The committee discusses the timeline. McCarthy then suggests that they share the preliminary findings with the agencies on Feb. 16th, possibly meeting with the agencies the week of the 20th. The committee will meet virtually on Feb. 23rd, which allows three weeks before the report is submitted. McCarthy requests questions or comments, and there are none.

The committee discusses the date of the June meeting, with McCarthy requesting members to fill out the Doodle poll so they can determine dates in real time, and Allison Farrow shares the link in the meeting chat. Abigail Vieregg notes that it would be good to prioritize the responses of those who will be members next year in setting the date for the June meeting. The committee discusses scheduling the meetings three years in advance in the future, so that members can arrange their schedules around existing meetings and can avoid the last-minute scramble for dates. There is discussion and coordination between committee members and the schedules of the agency leaders who give the AAAC reports regarding the June meeting, with the final decision that the meeting will be held June 6-7, with slides and minutes available for those who can't attend.

The committee then moves to schedule the September meeting, with the reminder that September is a half-day virtual meeting. Carrie Black proposes Sept. 20th, 12-5pm, saying that it is far enough away from any potential government shutdown to avoid complications. The committee agrees, and the date is set. The final scheduling decisions for the AAAC June and September meetings are June 6th-7th (full days), and Sept. 20th, 12-5pm.

There is a question about why the meeting recording is not made public, with the response that since the AAAC is a FACA committee, there are rules about what can and cannot be

made public. Carrie Black says that while they can look into the question, don't count on it changing.

The committee discusses moving the January 2025 meeting to November 2024. Chris Smith proposes an updated meeting schedule with the goal of giving the committee more time to write the report:

- June (2-day meeting)
- September (.5 day virtual)
- Nov. (2-day meeting)
- Feb. (1 day virtual)

The committee debates the utility of January and December meetings, with Smith saying that while November is early for the 2-day meeting, he is concerned that January is too late and puts the committee under a tight timeline. Mike McCarthy notes that the current schedule (this year's schedule) gives the committee more time than they have had in previous years. The committee then discusses meeting in October vs. September and agrees that September is better because there is no risk of government shutdowns.

Chris Smith gives more details on the proposed moved-up schedule: the June meeting will be for agencies to share how they're using the AAAC's response, and any questions they want the AAAC to address. The committee will use the information from the June meeting to develop report topics, then finalize those topics in the September meeting. He envisions the committee using the September meeting to decide the agenda of the next 2-day meeting (whether in November or January) to get the rest of the information they need to write the report. There is discussion within the committee of the benefit of keeping the meeting closer to the report date to keep everything top-of-mind. Mike McCarthy notes that he likes the January meeting because it's easier to fold in the meeting after the AAS meeting. He also notes that it will be helpful if at the June meeting the agencies say what helped/what didn't help about the last report. There is discussion of the proposed updated timeline, with no final determination reached.

Mike McCarthy and Chris Smith thank everyone for their attendance and hard work, and the meeting ends.

End of Meeting