

<p>Minutes of the Meeting of the Astronomy and Astrophysics Advisory Committee 3-4 February 2014 National Science Foundation, Arlington, VA</p>
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Members attending: Andreas Albrecht (Chair)
Stefi Baum
James Buckley
William Cochran
Priscilla Cushman
Craig Hogan
Mordecai-Mark Mac Low (Vice Chair)

Geoffrey Marcy
Richard Matzner
Angela Olinto
Angela Speck
Suzanne Staggs
Paula Szkody

Agency personnel: James Ulvestad, NSF-AST
Maria Womack, NSF-AST
Elizabeth Pentecost, NSF-AST
Nigel Sharp, NSF-AST
Joan Schmelz, NSF-AST
Diana Phan, NSF-AST
Vernon Pankonin, NSF-AST
Richard Barvainis, NSF-AST
Daniel Evans, NSF-AST
Scott Horner, NSF-LFO
Vladimir Papitashvili, NSF-OPP
Randy Phelps, NSF-OIIA
Jean Cottam, NSF-PHY

Greg Mack, NSF-PHY
James Whitmore, NSF-PHY
Paul Hertz, NASA
Hashima Hasan, NASA
Eric Tollestrup, NASA
Rita Sambruna, NASA
Linda Sparke, NASA
Kathleen Turner, DOE
James Siegrist, DOE
Helmut Marsiske, DOE
Anwar Bhatti, DOE
Jerry Blazey, OSTP

Others: Joel Parriott, AAS
Josh Shiode, AAS
Bettina Shulfert, AAS
Chris Carter, Univ. of CA
Miriam Quintal, Lewis-Burke
Trelene Ricks, AASU
Karin Hilser, USRA
Dominic Benford, NASA

Peter Lawson, JPL
Pete Roming, SWRI
Mario Perez, NASA
Jeff Foust
Ingolf Heinrichsen, NASA
M. Lystrup, Ball Aerospace
Wes Taub, JPL
Ed Ajhar, St. Thomas University

MEETING CONVENED 9:00 AM EST, 3 February 2014

The Chair called the meeting to order. Introductions were done.

The minutes from the 30 November -1 December 2013 meeting were approved by the Committee [Note: Geoff Marcy provided additional edits that will be incorporated into the minutes.]

Elizabeth Pentecost, the AAAC Recording Secretary, reviewed the list of identified Conflicts of Interest (COIs) for the AAAC. There were no additional changes to the list. The list will be distributed again before the June 10 teleconference.

The Committee spent some time discussing the latest draft of the Principles document. At the November meeting, Committee members were asked to provide comments/edits on the document to Priscilla Cushman for an update to the preamble. The Committee was asked to spend a few minutes looking at the

current draft of the document and make final editorial changes. The document will be referenced in the annual report and posted on the AAAC web site.

Paul Hertz presented an update on NASA activities. This remains a time of scientific opportunity for NASA Astrophysics. The budget for NASA astrophysics, which includes JWST, continues at \$1.3B in FY14, a high level. NASA continues to operate large and small space-based observatories spanning the electromagnetic spectrum, including multiple Great Observatories. The James Webb Space Telescope (JWST), the highest priority of the science community, is on schedule and fully funded for an October 2018 launch. NASA continues to develop contributions to international missions for launch this decade. NASA has down-selected two new Explorer projects to begin development for launch in this decade. NASA continues to support individual investigators for data analysis, theory, and technology investigations through open, competitive, peer reviewed processes. NASA is preparing for the strategic mission that will follow JWST.

The Astrophysics Division is currently conducting a Senior Review for their operating missions. The missions being reviewed include Hubble, Chandra, Fermi, NuSTAR, Spitzer, Suzaku, Swift, XMM-Newton, and possibly Kepler, Planck, and WISE.

Jim Buckley asked Hertz if SOFIA were to be grounded for a year, would there be any savings. Hertz replied that if SOFIA were grounded for a year with the intent to fly it in the future, you would save the fuel costs, the grants not being given to guest investigators, but it would depend on what was meant by “not flying it.” SOFIA is developed with a plan to operate for 20 years and NASA has made sure that any systems upgrades are robust enough for 20 years (airplane spares program in place). At an appropriate time, SOFIA will enter a Senior Review. SOFIA needs to have sufficient normal operations so that there is a base by which it can be evaluated and compare it to the other opportunities to the Senior Review wedge. Its prime mission will start in late February.

However, the budget future for astrophysics remains uncertain. Priorities must be used to guide difficult budget choices. The Division’s strategy is to use the scientific priorities of the 2010 Decadal Survey to guide strategy and help to inform choices. There is inadequate budget to implement the 2010 Decadal Survey recommendations as written. A goal is to be prepared to start a new strategic NASA Astrophysics mission to follow JWST as soon as funding becomes available, while continuing to advance Decadal Survey science during the interim. As appropriate, the Division will collaborate with international partners to realize the Decadal Survey priorities and recommendations, i.e., Euclid, L2, and L3).

The FY 2014 President’s Budget Request (PBR) requested \$642M for the Astrophysics Division and \$658M for JWST. The request includes full funding required for JWST, new projects for TESS (Transiting Exoplanet Survey Satellite), NICER (Neutron star Interior Composition ExploreR), Euclid; mission extensions per the 2012 Senior Review; core funding for research and suborbital projects; and a budget planning wedge for strategic missions starting in FY 2017.

The final FY 2014 appropriation is \$668M for Astrophysics and \$658M for JWST. The JWST plan for a 2018 launch is fully funded. The budget is \$26M higher for Astrophysics than requested, including \$56M directed funding for WFIRST/AFTA studies. The remainder of the budget must be adjusted to accommodate the \$30M difference. This will be determined through the development of the NASA FY 2014 operating plan. The budget does not include any restoration of funding for E/PO, but it does direct the Science Mission Directorate to continue conducting E/PO and to consider consolidation at the Division level.

Hertz gave an update on JWST. The project has entered its long and challenging integration and test activities. Technical progress continues to be significant. The project is performing within

the budget, and to schedule. The government shutdown did not impact the October 2018 launch date. FY 2014 is the peak funding year with many critical activities.

In May 2013, the NASA Administrator directed the Astrophysics Division to study WFIRST-AFTA (Widefield Infrared Survey Telescope-Astrophysics Focused Telescope Assets) and preserve an option for a FY 2017 new start if the budget is available. No decision is expected before early 2016. The Division is currently in the pre-formulation phase, an NRC study in early 2014, and a SDT final report in January 2015.

Major activities for CY 2014 include confirming the NICER Explorer Mission of Opportunity, the Senior Review for operating missions, completion and test of the JWST instrument suite, delivering ISS-CREAM for launch to the Space Station, commissioning three more SOFIA instruments, and participating in ESA's L2 mission study.

Funding for the Astrophysics Research Program has seen a 20% growth of \$65M in FY 2007 to \$82M in FY 2013. The proposal numbers over the same period have grown faster than the funding, up 75% from ~400 in FY 2007 to over 700 in FY 2013.

The Astrophysics Division undertook a roadmap exercise looking at a 30-year vision. The Roadmap presents a compelling, 30-year vision for astrophysics. The roadmap team took the recent decadal survey as the starting point and built upon it. The Roadmap is science-based, with notional missions. Community input was solicited and presented in a workshop in the form of a Town Hall. The Roadmap was released publicly in mid-December 2013.

Geoff Marcy noted that JWST and WFIRST are two of the biggest projects that NASA Astrophysics has. He asked Hertz whether there was some role the AAAC could play in support one or both of them; support his selection of options in the context of JWST, WFIRST, and NWNH. Hertz replied that JWST is the highest priority large mission being developed and WFIRST is the large mission to follow JWST. In the current budget environment, they cannot be developed at the same time; can't start WFIRST earlier unless the budget increases and no one has told him the budget is going up. Astrophysics has studied several different options for WFIRST and they are looking to the CAA and NRC to assess the quality of those options, especially whether they may or may not be responsive to the decadal survey. There are a number of ongoing study teams that will be reporting out next January and the current plan is to ask the NRC to look at the suite of missions Astrophysics has been studying and to advise NASA on the pros and cons of them as they might be responsive to the recommendations of the decadal survey. Should budget availability open up after JWST, that availability would start around 2017; next summer is when the budget for 2017 will be formulated so this input will be very valuable to the Division to make a request for a mission to follow JWST. Hertz does ask the AAAC to provide feedback on whether NASA has things right in their response to the decadal survey.

Kathy Turner gave an update on DOE activities. The FY2014 PBR for High Energy Astrophysics (HEP) was \$776M. The current FY 2014 funding plan was based on the continuing resolution through January 15, 2014 with a FY 2013 "bottom line" budget of \$748M. HEP was not able to start fabrication on new projects in FY 2013.

The final FY 2014 HEP budget was approved and is up \$21M from the PBR, but with specific guidance for the \$21M. Program planning in this budget environment is very difficult due to not having a stable budget. Projects approved for in the FY 2014 budget are the LSST camera (at \$22M), Belle-II, Muon g-2 and Muon to electron conversion (m2e) experiment. Specific guidance in the approved budget for the additional \$21M was provided for LBNE and the Homestake Mine operations.

The US HEP program is following the strategic plan laid out by the previous HEPAP/P5 (Particle Physics Project Prioritization) Panel studies. Though some of the boundary conditions have changed. HEP is still trying to implement the 2008 strategic plan within the current constraints. HEP is currently actively engaged with the community in developing a new strategic plan through the Snowmass/P5 process. There is an increased emphasis on broader impacts via accelerator stewardship, focusing on areas where the US can have leadership. The P5 report is due in May 2014.

Through ground-based telescopes, space missions, and deep underground detectors, research at the cosmic frontier aims to explore dark energy and dark matter. The FY 2014 PBR is \$91.034M for the Cosmic Frontier.

Currently the Dark Energy program consists of the Baryon Oscillation Spectroscopic Survey (BOSS), DES, and the supernova surveys. There is some science effort on WFIRST and Euclid but no plan for participation in the projects. LSST is the priority for the next HEP dark energy project to be developed. NSF is the lead agency responsible for the telescope and data management; DOE is responsible for the camera. The LSST camera was approved for fabrication in the FY 2014 budget. Future planning may include DESI. DOE also funds experiments measuring properties of high energy cosmic rays and gamma rays such as the Alpha Magnetic Spectrometer (AMS) experiment onboard the International Space Station, the Pierre Auger Observatory, the Fermi Gamma-ray Space Telescope (FGST), the Very Energetic Radiation Imaging Telescope Array System (VERITAS), and the High Altitude Water Cherenkov (HAWC) gamma-ray observatory. There is also an extensive program in direct-detection dark matter experiments.

Considerations for research support include priorities to support efforts in the programs that HEP has responsibility for experiments, working in collaborative arrangements, and increasing university involvement in dark energy and dark matter. The amount requested in FY 2013 for grant money was \$7.7M (for 28 proposals) and the amount funded was \$3.4M (for 20 proposals), with a success rate of around 71%. FY 2014 proposals are still being processed. Beginning in FY 2014, the DOE/Office of Science will transition to full funding of multi-year grants and/or cooperative agreements received from academic institutions with total cost less than \$1M (funds for the entire award has to be obligated at time of award). Annual research performance progress reports will still be required by PIs.

Priscilla Cushman commented that it will be hard to respond to P5 if monies stay with certain Frontiers (Energy, Intensity vs. Cosmic) rigorously. People do move from one Frontier to the other and it is hard to plan if the money stays within a certain Frontier. Turner indicated that if the P5 report states that DOE must support a certain research project or program, then it will have to implement a research program and look at the different funding levels as they move forward; happens within the Frontier now. It is not easy for high-energy physicists to move from one Frontier to the other; it is easier if they join a collaboration, start getting involved and making a contribution so that they review well.

Hertz commented that the AAAC may want to think about the reports, i.e., dark energy, CMB, etc., that might be necessary to prepare over the next few years in advance of the mid-decadal survey review.

James Ulvestad presented an update on AST activities. He aims to achieve a scientific program that is balanced between the major facilities, mid-scale programs, and individual investigator programs within fairly constrained budgets. Since the November 2013 AAAC meeting, key Division activities have included the Final Design Review for LSST, the renaming of ATST, invitations to 12 groups to submit full proposal to the Mid-Scale Innovations Program (MSIP), and Congressional passage of the FY 2014 NSF appropriation.

Ulvestad provided some programmatic and science highlights. ALMA has been providing some high-impact science results, one of which was featured in *Nature*. GPI passed its commissioning tests at Gemini South and was able to detect and characterize giant planets $<10^{-6}$ brightness of the parent star. A campaign to image ~600 exoplanets orbiting nearby stars begins later in the year. There has been a lot of work done on Haleakala for the ATST. The telescope was renamed the Daniel K. Inouye Solar Telescope in December. Operation status is scheduled for mid-2019. A 6.4 magnitude earthquake hit Puerto Rico January 13. It was centered approximately 100 km from Arecibo. There was damage to one of the six cables supporting the Gregorian platform. The telescope is likely to be down until March.

A Dear Colleague Letter (DCL) for the Portfolio Review (PR) was released and outlined the next steps for every telescope that was subject of a divestment-related recommendation in the PR report. The primary focus is to move forward toward a formal consideration of alternatives for each telescope. Consideration of alternatives is a formal process that must comply with National Environmental Policy Act (NEPA), National Historic Preservation Act (NHPA), and Endangered Species Act (ESA).

Ulvestad provided some recent progress results on LSST. The primary-tertiary mirror is on track to complete its final polishing in the summer 2014. The secondary mirror contract is in place and the telescope mount assembly bids have been reviewed, a vendor recommended, and negotiations started. The summit facility construction bids are due in early March. The Final Design Review was held in December. AST is aiming for approval of a construction award by the National Science Board at their May meeting (LSST FDR originally scheduled for late October; delayed due to the lapse in appropriations).

The Mid-Scale Innovations Program (MSIP) was the #2 priority large program recommended by *New Worlds, New Horizons* decadal survey. A solicitation was released in June 2013. Thirty-eight pre-proposals were received in September in four categories (mid-scale science projects, mid-scale facilities, development investments, and open access capabilities) and reviewed with 12 groups being invited to submit full proposals (due March 12).

Ulvestad described the budget situation. The NSF FY 2014 PBR was \$7.62M and the appropriation was \$7.17M. The budgets for MPS and AST are unknown until the FY 2014 plan is submitted to Congress and approved. There is a request of \$42M for DKIST and \$27.5M for LSST. Congress reduced the MREFC line to \$200M with language that has funding for ongoing projects at the request level and the remainder for LSST; NSF was given permission to request fund transfers.

In the grants programs, there were 758 projects received in 2013 (with a 15.4% success rate). The number of proposals received in FY 2014 is approximately equal to FY 2013. There are plans to make earlier award decisions because of an earlier appropriation. The Division is anticipating funding rates near 10% in the near future which is of great concern. Options are being considered.

NSF is working with DOE on a possible future path for the Mayall telescope on Kitt Peak for DESI; this will depend on the P5 report and the DOE HEP funding outlook. NSF and NASA are in preliminary discussions regarding ground telescope availability for radial velocity measurements (exoplanets/TESS).

Stefi Baum was concerned about the Virtual Astronomical Observatory (VAO) and the lack of coordination and coherence among the two agencies. Ulvestad indicated that the amount of money either agency was putting in VAO is dwarfed by the amount of money that is going into the NASA data centers, the archives at NSF centers, the data management in DES and LSST; if NASA and NSF were to fund the VAO and take over a leadership role in how data is distributed it would have to turn off all its other data centers and fund the VAO at a much higher number. There is no formal joint oversight group but both agency program officers do coordinate among themselves. Once the cooperative agreement ends, the

plan is for NASA to take over the continuing infrastructure and NSF to fund new applications through its grants program. Paula Szkody would like to see a single place to obtain the data (space-based and ground-based data). Several committee members suggested a task force to look into the issue.

Steve Ritz, Chair of the P5 subcommittee of HEPAP provided an update on their activities. The particle physics community is developing an updated strategic plan for the United States that can be executed over a ten-year timescale, in the context of a twenty-year global vision for the field. P5 is charged with developing this plan under various budget scenarios. The P5 process follows a year-long Snowmass process organized by the American Physical Society's Division of Particles and Fields. Through the Snowmass process the U.S. particle physics research community identified the most compelling scientific opportunities and the technologies required to seize those opportunities. The Snowmass process culminated in a nine-day meeting at the University of Minnesota in July and August of 2013. The final Snowmass reports, expected in November, will serve as input to P5. There will also be mechanisms for the particle physics community to provide input, documents, and feedback to P5. Preliminary comments are expected to be presented at the HEPAP meeting in early March. The final report is due in May.

Angela Olinto asked whether the recommendations will be presented to HEPAP and the AAAC. Ritz replied that after the recommendations are presented to HEPAP in March and May, there will be several virtual town halls. Any collaborative efforts will be noted and encouraged. The Chair noted that DOE will be informing the AAAC how they will respond to the P5 recommendations at the June AAAC meeting.

Ritz indicated the P5 panel would value any feedback from the AAAC.

The Committee spent time discussing the need for more quantitative data on the grants programs from the agencies, i.e., number of proposals (breakdown by category), proposal success rates, budgets, etc., in order to provide advice on ways to maximize the science while dealing with increasing proposal numbers and decreasing or flat budgets. The agencies were asked to provide these statistics for the next meeting. There is some concern that funding is going for large projects and national laboratories at the expense of the university community (grants).

The AAAC finalized the Principles document.

MEETING ADJOURNED AT 5:00 PM EST, 3 FEBRUARY 2014
MEETING RECONVENED AT 9:00 AM EST, 4 FEBRUARY 2014

The Committee elected Priscilla Cushman as the next Chair and Angela Olinto as Vice-Chair.

The June 10 telecon will include an update from the agencies on their 2015 budgets and a first set of reactions to the Committee's annual report and possible implementation of the committee's recommendations.

The Committee selected the Fall 2014 date, November 17-18 for the next face-to-face meeting.

The Committee spent some time discussing an outline of the annual report that is due on March 15, 2014. Issues such as community access, open skies, data, challenges and opportunities, will be incorporated into the report.

MEETING ADJOURNED AT 11:25 AM EST, 4 FEBRUARY 2014