

**Minutes of the Meeting of the
Astronomy and Astrophysics Advisory Committee**

**13-14 October 2011
National Science Foundation, Arlington, VA**

Members attending:	Andreas Albrecht Sarah Church (Chair) Debra Elmegreen Joshua Frieman Martha Haynes (Vice-Chair) Gregory Laughlin Mordecai-Mark Mac Low	Richard Matzner Paul Vanden Bout John Wefel Brian Winer Charles Woodward
Agency personnel:	James Ulvestad, NSF-AST Thomas Statler, NSF-AST Vernon Pankonin, NSF-AST Elizabeth Pentecost, NSF-AST Ed Ajhar, NSF-AST Dana Lehr, NSF-AST Craig Foltz, NSF-AST Nigel Sharp, NSF-AST Donald Terndrup, NSF-AST Maria Womack, NSF-AST Christer Watson, AAAS Fellow-AST Randy Phelps, NSF-OIA Vladimir Papitashvili, NSF-OPP Bill Miller, NSF-LFO Kristin Ludwig, NSF-LFO	Phillip Schwartz, NSF-LFO Geoff Yoder, NASA Rita Sambruna, NASA Thierry Lanz, NASA Hashima Hasan, NASA John Mather, NASA Vernon Jones, NASA James Green, NASA Louis Kaluzienski, NASA Lia LaPiana, NASA Linda Sparke, NASA Kathleen Turner, DOE Michael Salamon, DOE James Seigrist, DOE Lali Chatterjee, DOE
Others:	Daniella Piskorz, NAS/SSB Brad Keelor, British Embassy Kaitlin Chell, Caltech Jon Morse, RPI Peter Nugent, LBNL Jeff Murfess, <i>Science</i>	Michael Ledford, Lewis-Burke Michael Devirian, JPL Randall Correll, Ball Aerospace Paul Schechter, MIT Eric Hand, <i>Nature</i>

MEETING CONVENED 9:00 AM EDT, 13 OCTOBER 2011

The Chair called the meeting to order.

The minutes from the 6 May meeting were approved by the Committee.

Elizabeth Pentecost, the AAAC Recording Secretary, reviewed the list of identified Conflicts of Interest (COIs) for the AAAC. There were no new updates. The list will be distributed again before the February 2012 meeting.

Geoff Yoder presented an update on NASA programs and budget. First, he reported that Ed Weiler had retired and NASA is currently looking for a new Associate Administrator for the Science Missions Directorate. Jon Morse moved to RPI. Yoder is Acting Director for the Astrophysics Division and Deputy Director.

The FY12 budget has not been approved yet, but there is an increase of ~\$50M from the FY11 actuals. There was an increase in the Explorer line in the budget to increase those activities. The NuStar launch is scheduled for spring 2012. The sounding rocket program is back on track. An announcement of opportunity for the second generation instruments on SOFIA was released in July with a deadline of October 7. The first international deployment to Germany and stopover at Andrews Air Force Base took place in September. The Lisa Pathfinder mission is slated for launch in 2014. The Antarctic is the centerpiece of the balloon program; it is a low cost access to space. Right now balloon duration flight duration is a maximum of 60 days; we want to go up to 100 days.

NASA uses the Senior Review process to maximize scientific productivity of operating missions which have completed operations. They are held every two years and evaluate proposals for continued funding for its operating missions. It is the highest level of peer review within the Astrophysics program. Missions in this review include all operating missions in the astrophysics portfolio that have completed their Level -1 requirements and completed prime operations. Changes to the 2012 Senior Review include a better defined process for inviting missions into the Senior Review. EPO will now be a part of the 2012 Senior Review; in 2010 it had been reviewed separately after the Senior Review. Hubble, Kepler, and Fermi have been invited to the 2012 review.

Continuation of the Explorer program was a recommendation of the Decadal Survey. As a result of the recommendation, a future Astrophysics Explorer missions budget was created to increase the flight rate to achieve the recommended four missions and four missions of opportunity selected by the end of the decade. The September selection had 15 Astrophysics Explorer mission proposals and 11 Astrophysics Missions of Opportunity (MoO) proposals. There were 2 Explorer selections and 2 MoO selections.

The division has made an effort to improve communications with the community. A new Astrophysics Division Communication Plan has been created to provide timely communication to internal and external stakeholders and to improve communication with the scientific community and the public. Quarterly program office meetings have been established to improve communication between program offices and to build outreach. The Astrophysics Division is being updated.

The Division has been gathering information for x-ray and gravitational wave (GW) concept studies from the community through a request for information (RFI). The RFI solicits concepts for missions, instruments and enabling technology for future x-ray and GW missions. A community science team will be assembled to provide scientific guidance and concepts will be narrowed down through a community workshop to be held in mid December 2011, for both the X-ray and GW communities. The consolidated concepts emerging from the workshops will be presented to the NRC Committee on Astronomy and Astrophysics (CAA).

ESA recommended that Solar Orbiter and Euclid be selected as M1 and M2 missions, with Plato continuing in the competitive process for the M3 mission. ESA asked for a longer definition phase for Euclid than previously planned and will propose that the Science Programme

Committee adopt the mission in July 2012 instead of February 2012. The launch would be in Q4 2019. The workshop group adopted the two dark energy missions on October 4. NASA will not be working with ESA on a joint mission.

NASA and NSF are discussing a joint program in theory and computational networks that would advance both theoretical and computational astrophysics, address workforce development in new research techniques, and would be multidisciplinary. NSF and NASA plan to convene a workshop to collect input from the theoretical and computational astrophysics communities to better define the scope for a program. Based on a report from the workshop, the agencies will consider the opportunity to issue a joint solicitation.

Frieman asked how the international issues are taken into account during the Senior Review process. Yoder replied that if the SR recommends to go forward on an international project and the international partner says no to the partnership, the project does not go forward. NASA does coordinate with its international partners.

Frieman also asked about Euclid and discussions between NASA and ESA. Yoder replied that any discussions on US participation in Euclid will take place after ESA has gone through its evaluation and down select processes. They want to wait until that is done before any more dialogue between NASA and ESA takes place. Yoder will be visiting ESA in October to discuss collaborations.

Elmegreen asked Yoder to comment on the status of the CAA. Yoder replied that the CAA has not been stood up yet. It is something that is being discussed. It needs to be resolved relatively quickly because NASA wants the CAA to comment on the x-ray RFI. If there are changes to WFIRST, NASA would want the CAA to review those. Yoder did not know when the committee would be stood up but the idea is that it would be jointly with the Board on Physics and Astronomy (BPA) and the Space Studies Board (SSB), both NRC committees.

Vanden Bout asked Yoder to comment on when SOFIA would have its first Senior Review. Yoder replied that SOFIA is still in development. It is anticipated that it would have its SR in 2018. That would give it a steady cadence to produce good science. He would like it to achieve 800-900 hours of science per year.

Mac Low made an inquiry about the Technology Fellowships. He asked how the career-path people, who get a one year fellowship and do not receive a follow-on four year fellowship, are expected to proceed since they have to apply for new jobs. Is there some sort of down ramp for them? Linda Sparke replied these scientists can put this career opportunity on their CV. They get to do a study which they wanted to do anyhow and also have an opportunity to write another proposal for something else. Woodward asked about metrics for evaluating the success of the program. Yoder replied that they plan to evaluate the process after the fellowship program has been established for a while. It will be a difficult challenge and the Division is starting to take a look at how to foster the new and upcoming scientists in the era of tight resources.

Haynes asked whether Yoder has received any feedback on last year's AAAC report and whether the report has been helpful. Yoder replied that there are some things that are statements of fact and there are some things that NASA is already doing. Haynes went on to ask whether there are particular points that must be addressed in this year's report in order to be helpful. Yoder replied that the topic of theory and computational networks is an area that could be addressed in the report. Even the areas that are statements of fact are important to NASA.

Frieman noted that there are budget uncertainties, but asked Yoder to comment on the budget planning process. Will there be future resources available? Yoder replied that the division has a budget of roughly \$700M/year and it needs to focus on the priority projects that will go forward. There is no longer a wedge opening for a large mission until after JWST launches in the 2018 timeframe; that would be the time when any appreciable wedge might open up. There is still a responsibility of moving forward. Let's do the best we can and not over promise.

Paul Schechter and James Green provided an update on WFIRST. WFIRST is the highest ranked large space mission in the Decadal Survey. The science objectives for the mission are to complete the statistical census of galactic planetary systems using microlensing, determine the nature of the dark energy that is driving the current accelerating expansion of the universe and survey the near-IR sky through guest investigator programs. This is a five-year mission. The design reference mission has a 1.3m unobstructed telescope with a near-IR instrument with ~36 HgCdTe detectors. WFIRST is compliant with the Decadal Survey recommendation for groundbreaking observations in dark energy, exoplanet and near-IR sky surveys. The dark energy techniques each provide different physical observables and unique information. WFIRST meets or comes close to meeting the time allocations and sky coverages given in the EOS Panel report. One of the questions posed to the Science Definition team (SDT) was "How would WFIRST change if Euclid is selected?" The SDT concluded that due to the importance of the scientific questions and need for verification of results, WFIRST should proceed with all of its observational capabilities intact regardless of the ESA decision on Euclid. WFIRST also has a superior design for baryon acoustic oscillations and weak lensing and has unique coverage of supernovae and exoplanet microlensing. Because Euclid was selected by ESA, the issue of changes to WFIRST will be revisited at a later date. Should NASA and ESA decide to pursue a joint mission or program, all of the scientific approaches and broad objectives currently included in WFIRST must be included in the joint mission or program. The interim design reference mission design/analysis cycle is underway and continuing into FY12.

Woodward noted that the development of WFIRST is going on while JWST is being developed toward launch. WFIRST is a US-led mission. Has NASA considered international partners? Green replied that WFIRST should be completed by the end of the decade or close (2020 or 2021). WFIRST could be developed in parallel with JWST.

Frieman asked whether the SDT plans to look in more detail the tradeoffs involving Euclid. Green replied that there will not be a major change in Euclid. We are waiting to hear from NASA on any US involvement in Euclid or any merged programs. Yoder commented that NASA is having discussions with the Europeans on Euclid. Another question is what requirements does WFIRST have for using ground-based data? Schechter replied that ground-based data will be needed to complement the WFIRST optical data.

Eric Smith provided an update on the James Webb Space Telescope (JWST). JWST is the scientific and technological successor to HST and Spitzer. JWST has more than six times the collecting area of HST, 100 times more sensitive than HST, and half the mass of HST. An Independent Comprehensive Review Panel (ICRP) was convened because of the huge cost overruns. The committee report was submitted to Congress in October 2010 and confirmed that there were no technical issues on JWST, however, management oversight needed to be changed. NASA agreed with all of the recommendations from the ICRP. NASA made program and project management changes that included replacing JWST senior management at GSFC and HQ as well as elevating JWST to a division level in the Science Mission Directorate. The JWST program office reports weekly to the NASA Associate Administrator. The replanned JWST program supports an October 2018 launch date. The replan has adequate cost and schedule reserves

consistent with an 80% confidence level. The project has made progress in FY11, achieving milestones within cost and schedule. Total additional funds required for FY2012-2016 is \$1223M (FY2012-\$156M; FY2013-2016 - \$1067M). NASA must provide a report to Congress detailing projected cost and schedule for completing the program as well as an assessment of a broad range of alternatives to the program. The program office must develop fiscal year 2012 high-level milestones for external reporting. There are discussions underway to accelerate the spacecraft critical design review by 4-6 months as well as pulling in the schedule on the primary mirror backplane assembly by 6-8 months. The final tests of the six remaining primary mirror segment arrays have been accelerated and will be completed by the end of 2011.

Frieman asked what the total project cost to launch is for JWST from inception? Smith replied \$8B, of which \$3.5B has already been spent. There is \$530M for FY12 which is consistent with the re-plan, with a 2018 launch.

Woodward asked about the flight capabilities of the instruments since the launch is not until 2018. Smith replied they are looking at the capabilities of the instruments given the fact that they will be in storage for a few years. An unrelated (to storage) problem was discovered with the near-IR detectors and they will have to be re-made. The budget for replacement of the detectors was included in the replan.

John Mather presented a seminar on JWST science during the lunch break.

James Ulvestad presented an update on the FY12 NSF/AST budget. He first provided some programmatic updates on the ALMA project. There are forty-four antennas in Chile. The first science observations started on September 30; 112 projects were selected from over 900 proposals. Final North American deliverables (antennas and receivers) are on course for completion in September 2012. The ATST environmental appeal is in its final stages. The project is still aiming for construction to start in 2012 with end of commissioning in late 2018. Gemini is making progress on getting new instruments on the telescopes. Especially on Gemini-S, there will be some real new capabilities in the next few years. EVLA will be completed on time and on budget. Early science for EVLA generated ~34 papers in ApJ. Arecibo Observatory transferred to a new managing organization, SRI International, October 1. This is a funding partnership among AST, NSF/AGS, and NASA. The Dark Energy Survey at the NOAO/CTIO 4m Blanco telescope is scheduled to start in September 2012. This is a collaboration between NSF and DOE who is providing the camera for the telescope. BigBOSS is under discussion with a possible execution at the 4m Mayall telescope on Kitt Peak; NSF funding is dependent on a mid-scale competition. However, there will be no new starts for mid-scale instrumentation in FY12.

Ulvestad informed the committee that the 2012/2013 NSF budget indicates a downward trend for AST. An OMB memo to agencies asked for 5% and 10% reduction scenarios in the FY13 requests. Cumulative budget changes are already having a significant long-term impact. There will be no new unsolicited mid-scale proposals funded in FY 2012. AST may need to be prepared to take significant action once the President's 2013 budget is released in February 2012, which may include divestment of individual facilities and restructuring observatory operations.

Astro2010 made a recommendation to conduct a program review before mid-decade if there was no possibility of implementing the recommendations of the decadal survey and enacting the recommendations of the first senior review. The AST Portfolio Review will look at the balance across all programs to align them with the science questions outlined in Astro2010. It will not be a repeat of the senior review which was confined to facilities. It is supposed to maximize

progress on central science questions, balancing recommendations for new facilities and instrumentation with capabilities of existing facilities and programs. Ulvestad would like the AAAC to comment on what AST should be doing on a GSMT selection. A redefinition of the role of the AAAC is another topic of discussion for the Committee.

Tom Statler provided an update on the AST Portfolio Review. He reiterated that the Portfolio Review will not be a repeat of the Senior Review, which was confined to facilities. It will examine the balance across the entire portfolio of activities AST supports, balancing recommendation for new facilities and instrumentation with capabilities of existing facilities and programs. The goal is to define the astronomical landscape for the coming decade and beyond, letting the key science questions from Astro2010 determine a set of critical capabilities needed in 2015, 2020, and 2025. Multiple budget scenarios through 2025 will be provided by AST to the review committee. There will be no revisiting the recommendations or process of the decadal survey. The review will include joint programs (NASA and DOE), private observatories and international activities, and will consider the consequences for domestic, international partnerships, and on the state of the profession. Public announcements of the Portfolio Review were made at the May AAS meeting and via AAS and APS/APD distribution lists. Nominations for committee membership were accepted from the community and a 17 member committee was formed. The committee has met by telecon and will meet for their first face-to-face meeting October 21-23. There will be an opportunity for community input.

Haynes asked about the timescale for the Portfolio Committee's report. Ulvestad commented that a draft report was anticipated around March with a final report in the July/August timeframe, which would still allow for input into the 2014 budget. The input portal for community input would be open next week; it will be announced by the AAS and discussed by Jim at the January AAS meeting.

Woodward made a comment about the horizon effect of the portfolio review. Ulvestad replied that the division is essentially 55-60% Facilities (depending on how it is counted); it takes time to turn the ship. We need to know where we'll be in the year 2025 to start to take action in 2017, 2018 or 2019, so that is why we have a horizon that goes beyond the next decadal survey. AST needs to carefully look at the role of the facilities and how they interact with the grants program because the way AST has done business in the past may not be the way to do business in the future.

Nigel Sharp provided an update on the Large Synoptic Survey Telescope (LSST) project. The 2010 NRC Decadal Survey ranked the LSST as the highest priority large-scale ground-based project. The project costs are \$626M including \$158M from DOE and \$39M for private sources; this includes commissioning. The LSST has a ten year primary mission. NSF completed the Preliminary Design Review (PDR) in September. The review panel considered that the LSST project has met the requirements of the PDR. The PDR report included 36 recommendations, most noteworthy issues were related to risk management and to operations funding. A MOU between NSF and DOE has been drafted. The DOE CD-1 review of the camera has been scheduled for November; it is a prerequisite for CD-1 approval. A request for approval to enter the MREFC line is planned for the first half of 2012; the earliest budget would be FY2014. The project is likely to request a significant increase in NSF D&D funding in FY2013, which will be difficult to provide. Operating costs are estimated at ~\$37M per year. NSF and DOE have ways of providing their share but another \$9M is needed from other sources. Those might include NASA (study of NEOs), ESO, individual foreign partners, and private donors. De-scope options are also a possibility, but the PDR panel recommended that the project not de-scope. There will be no proprietary period for the data for US and Chilean institutions.

Woodward asked about public/private funding. Sharp replied that it is much easier to get private money for construction and it is difficult to get private foundation money for operations; hard for people to commit funds for operations ahead of time. Sharp has been trying to get the project to get conditional commitments which would be helpful.

Woodward asked the question, is the issue of open skies being looked at with respect to LSST? Ulvestad replied that it is a very difficult situation because for instance, the access to the VLT for a US astronomer is not the same as the access for Keck for the European astronomer. It also brings up issues like operations cost for such projects as the LHC which go beyond the purview of AST. Sharp commented that in his opinion, people should contribute because it is a very impressive project. Haynes commented that many of the projects that the Europeans are planning to do in the future will need LSST data and it may be time to say to them that if they want the data they may need to contribute to operations.

Frieman asked whether there are plans for follow-on spectroscopic studies. Ulvestad replied that there may be ways to have telescopes such as Gemini or SOAR do follow-on studies using the LSST data. There have been early discussions but there is no strategic vision as of yet.

Tom Statler and Thierry Lanz gave a brief presentation on Theory and Computation Networks (TCNs). TCN was a recommendation of the Decadal Survey. The recommendation was for a program funded by NASA, DOE, and NSF supporting research in six to eight focus areas that cover major theoretical questions raised by the survey science frontier panels. The networks would be devoted to topics ready for a breakthrough within five years. The selection criteria would include the degree of cross-institutional synergy in the network and its planned role in training and mentoring the next generation of researchers. Funding would normally be for a five-year period. Discussions on TCN took place in the first half of 2011. DOE expressed a view that their existing programs already support theory and computation and their participation in a new joint solicitation was unlikely. A NASA-NSF MOU addendum is being prepared that will request the AAAC to organize a workshop bringing together experts from the theory and computation community and agency representatives in order to help recommend the desirable parameters of a TCN program. The intent of the workshop report is to inform drafting of a joint solicitation later in 2012.

Greg Laughlin and Mordecai-Mark Mac Low offered to help coordinate the TCN workshop. Kathy Turner suggested that they contact Lali Chatterjee at DOE since she is program manager for HEP's computation program.

Kathy Turner provided an update on DOE programs and budgets. She first announced that there have been some staff changes in the Office of High Energy Physics. Jim Siegrist joined HEP as the new Associate Director, Lali Chatterjee moved to HEP to serve as the Computational program manager, and Simona Rolli joined HEP to serve as the Theory program manager.

The High Energy Physics program's mission is to understand how the universe works at its most fundamental level. To enable discoveries, HEP supports theoretical and experimental research in both elementary particle physics and fundamental accelerator science and technology. Progress in achieving the mission goals requires advancements at the Energy, Intensity and Cosmic Frontiers. It is a balanced program of projects in all three frontiers.

The FY12 request of \$797.2M included \$19M of SBIR/STTR grants, which has been removed from the FY10 and FY11 actuals. The real FY12 request was a reduction of approximately \$2M

from FY11 and \$12M from FY10. As with the other agencies, DOE is currently in a continuing resolution. During the 90's, the fraction of the HEP budget devoted to projects was ~20% but declined to <5% in 2006. HEP's strategy is to work to increase that back to 20%. With flat funding, HEP has to end programs to start new ones. DOE is only doing one major dark energy experiment, LSST. The Tevatron was shutdown at the end of FY11 after 30 years of operations.

The Astro2010 recommendations for DOE are part of a coordinated ground/space-based dark energy program that includes LSST and WFIRST. LSST was recommended as the priority because DOE's role is critical; DOE is responsible for the camera. DOE is funding several joint dark energy programs with NSF that include BOSS and DES (Dark Energy Survey-camera). Any involvement in WFIRST would be with NASA. DOE is supporting several persons on the WFIRST Science Definition team. DOE has collaborations with NSF for Veritas, Auger, and HAWC. DOE partnered with NASA on the Large Area Telescope (LAT) for the Fermi Gamma-ray Space Telescope and now hosts the LAT instrument science operations center at SLAC. Groups from the DOE labs and their university partners have formed a collaboration to address the computational challenges relating to DOE HEP Cosmic Frontier research which include leveraging DOE and other high performance computing resources. The collaboration recently convened a planning meeting in September with the purpose to identify key challenges and possible consolidation of resources for computing at the Cosmic Frontier.

Peter Nugent gave a presentation on the science from Supernovae 2011fe in M101. All three agencies, NSF, NASA, and DOE, were involved in support for the research.

The Chair suggested several items for discussion: (1) role as a committee; (2) advice on a solicitation for a GSMT; (3) help organize a theory and computation networks workshop.

Frieman commented that there has been a lot of movement in the area of dark energy (i.e., LSST, Euclid), but he is concerned about a lack of a process to get them to optimally fit, both ground vs. space or internationally. Now might be the time to initiate a process. Given that there are finite resources, how do we relate a position for WFIRST relative to Euclid to promote dark energy and exoplanets?

Haynes suggested that the AAS might be interested in helping to organize the TCN workshop. Others suggested that it might be organized in-house within AST. In all instances, the charge for the workshop needed to be very specific. Involving industry participants might also be a good idea as well. Wefel suggested capitalizing on what DOE has already done in this area and bringing the information to the workshop for discussion.

The Committee decided on several meeting dates for 2012, February 10-11 and March 2 (teleconference). Exact dates for May and October/November were not agreed to by the Committee. A doodle poll will be sent out for possible dates for the other two meetings. Tom Statler was asked to poll OMB and OSTP to their preference for the October/November AAAC meeting.

MEETING ADJOURNED AT 5:00 PM EDT, 13 OCTOBER 2011
MEETING RECONVENED AT 9:00 AM EDT, 14 OCTOBER 2011

The Chair discussed the idea of a "Book of Interagency Activities." This would be an internal document listing activities/projects that are coordinated by the three agencies. Items that might be included in the "Book" would be a short description of the collaboration/coordination, a

budget associated with the activity, the timeframe for the project, and division of responsibility (who is lead agency, etc.). This would be beneficial to the Committee members, especially the new members. The agencies would provide the base information and the Committee would prepare the list document. The document would help in preparing the annual report. The Committee worked on preparing a preliminary list in real time.

The Committee spent time discussing the annual report. Most of the writing for the report will be done at the February meeting but the members should start to think about what should be included in the report.

MEETING ADJOURNED AT 12:00 PM EDT, 14 OCTOBER 2011