

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

**18-19 February 2009  
National Science Foundation, Arlington, VA**

<b>Members attending:</b>	Wendy Freedman (Chair) Bruce Balick Rocky Kolb David Koo Daniel Lester	Douglas Richstone Marcia Rieke Keivan Stassun (telecon) Alycia Weinberger Scott Dodelson
<b>Agency personnel:</b>	Craig Foltz, NSF-AST Eileen Friel, NSF-AST Philip Puxley, NSF-AST Donald Terndrup, NSF-AST Elizabeth Pentecost, NSF-AST Linda Sparke, NSF-AST Nigel Sharp, NSF-AST Vladimir Papitashvili, NSF-OPP Randy Phelps, NSF-OIA Emily Woodruff, NASA-OIG Joseph Dehmer, NSF-PHY William Miler, NSF-BFA Mark Coles, NSF-LFPO Jim Whitmore, NSF-PHY	Morris Aizenman, NSF-MPS Kathleen Turner, DOE-HEP Dennis Kovar, DOE-HEP Jon Morse, NASA-HQ Michael Salamon, NASA-HQ W. Vernon Jones, NASA-HQ Zlatan Tsvetanov, NASA-HQ Thierry Lanz, NASA-HQ Hashima Hasan, NASA-HQ Wilton Sanders, NASA-HQ Anne-Marie Novo-Gradac, NASA-HQ Eric Smith, NASA-HQ Wayne Van Citters, NSF-MPS
<b>Invited participants:</b>	John Henry Scott, OSTP Michael Moloney, NRC	Roger Blandford, Stanford (telecon)
<b>Other participants:</b>	Eric Hand, Nature Chuck Rudiger, Lockheed-Martin Michael Ledford, Lewis-Burke James Murday, USC Ron Allen, STSci Marcus Huerta, AAS Randall Correll, Ball Aerospace John McCarthy, Orbital	Robert Cahn, LBNL Michael McElwain, NAS Henry Ferguson, STSci Michael Devirian, NASA-JPL Jennifer Wiseman, NASA-GSFC Allison Trepod, SRI Ed Feddeman, U.S. House Sci. Comm. Jonathan Bagger, JHU

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**MEETING CONVENED AT 9:00 AM EST, 18 FEBRUARY 2009**

The Chair called the meeting to order. NSF Division of Astronomical Sciences (AST) Acting Division Director, Craig Foltz, made introductory comments and welcomed everyone to the meeting. Introductions were made around the room.

The Chair reviewed the agenda for the meeting and indicated that the format was different from past meetings. The Committee would hear presentations on joint programs and projects from the

Agencies rather than the usual Agency updates on budgets and programs. The Committee would also spend much of their time on the second day of the meeting discussing the content and format of the annual report.

Elizabeth Pentecost, the AAAC Executive Secretary, reviewed the list of identified COIs for the AAAC and updated the list for each member. The list will be updated and distributed at the start of each meeting.

The minutes from the October 14-15, 2008 were approved by the Committee.

With the decadal survey underway, there are restrictions on what the AAAC does with the information the agencies provide to the decadal survey committee. Once the decade survey and a prioritization of projects have been completed, the Committee would then need to be ready to move forward.

Jon Morse provided a brief overview of the National Aeronautics and Space Administration (NASA) joint projects with the Department of Energy's High Energy Physics (HEP) Division (see presentation for details). He concentrated on the Joint Dark Energy Mission (JDEM) and Fermi Gamma-ray Space Telescope. There are milestones in moving forward with JDEM. Joint planning was initiated with DOE under the guidance of the Office of Science and Technology Policy (OSTP) in the fall of 2007. A Figure-of-Merit Science Working Group (FOMSWG) chaired by Dr. Rocky Kolb was established and a report was delivered to NASA and DOE in 2008. A Science Coordination Group chaired by Dr. Neil Gehrels (NASA-GSFC) was established to develop the science requirements for a reference mission. These science requirements would also be inputs to the decadal survey. A draft Announcement of Opportunity (AO) was being planned for spring 2009. NASA has been in discussions with the European Space Agency (ESA) to develop a joint dark energy mission, a merger of ESA's Euclid mission [a combination of the dark universe explorer (DUNE) and the spectroscopic all-sky cosmology explorer (SPACE)] and JDEM. This potential merger would bring the limited resources of 2 M-class missions to a common Dark Energy Mission. The science goals of JDEM and Euclid are the same, the measurement of cosmological parameters via visible/near-infrared imaging and spectroscopic surveys. The Reference Mission designs for JDEM and Euclid have a large degree of overlap. The combined mission will save each Agency considerable cost and will enable them to do full space-based dark energy science as well as other programs. ESA was amenable to using the NASA AO process. The optimization of roles for NASA, ESA, and DOE are under review.

Kolb asked how the science communities in Europe and the United States will have input in the joint mission. Morse replied that scientists will use the AO process. ESA will represent the science community in Europe and they should be working with ESA in this regard.

The Chair asked whether the idea is to share costs. Morse replied that the details were being worked out. Contributions remain within resources.

Kovar noted that it was good news that the U.S. and Europe were working together and the discussions on how best to do proceed were being planned.

Balick commented on the budget for JDEM and the fact that NASA's resources were \$600M plus the launch vehicle. Morse noted that NASA was looking to defray costs and that they would get a more capable mission with ESA's participation. The objective was to keep the mission scope within resources to keep those resources available. Balick then asked how the project would

move forward if JDEM did not fare well in the decadal survey. Morse replied that NASA will redirect its efforts if the decadal survey does not give JDEM a high priority, but currently the portfolio of projects would move forward as indicated by other Academy reports, such as the 2007 BEPAC report.

Rieke commented that DOE was providing “in-kind” contributions and asked whether that was still the plan. Kovar replied that DOE had identified pieces of instruments to contribute to the project and that they would be looking to address the most completing opportunities in their Cosmic Frontier.

Richstone asked if ESA wanted to develop their part of the mission and if there were cost overruns, might NASA get stuck with the extra costs and how would this be handled with partnerships with other US agencies? Morse replied that there were clear managerial and fiscal interfaces between the partners and each would be responsible for their share of the costs.

Morse provided an update on the Fermi Gamma-ray Space Telescope (formerly the Gamma Ray Space Telescope (GLAST)). The Fermi collaboration includes 6 countries, 22 institutions and 400+ members. The DOE and NASA collaboration was on the Large Area Telescope (LAT). Another instrument on the telescope is the Gamma-ray Burst Monitor (GBM). Both instruments are performing flawlessly. Over three dozen pulsars have been detected, twelve new pulsars have been found directly in the gamma-rays, and eighteen additional pulsars have been seen for the first time as gamma-ray emitters. The GBM has detected over 150 gamma-ray bursts. Results are being published from the data.

Craig Foltz gave an overview of the joint projects between NSF and DOE (see presentation for details). The Large Synoptic Survey Telescope (LSST) has a total investment to date of approximately \$80M. This has included federal and non-federal funding. Construction costs are proposed to be borne by both NSF and DOE with an estimated total cost of approximately \$390M. A Conceptual Design Review (CDR) was held in late 2007 with a strong recommendation to proceed. The High Energy Physics Advisory Panel (HEPAP) P5 panel report in May 2008 recommended that DOE support the LSST program in coordination with NSF at a level that depended on the overall program budget. Both NSF and DOE decisions to recommend advancing to construction are pending while awaiting recommendations of the decadal survey. One of the recent milestones was the unanimous approval of the environmental impact statement (EIS) by the Chilean Regional Authority of the Environmental Protection Agency (COREMA), thereby granting the permits for LSST construction and operation on Cerro Pachón.

The Dark Energy Survey (DES), another joint project with DOE is a Stage III project as defined by the Dark Energy Task Force (DETF). Investment by DOE will be the camera. Improvements will be made to the Blanco telescope at the Cerro Tololo Interamerican Observatory (CTIO). The next planned review of DES has been scheduled for July 2009.

NSF will be funding the Sloan Digital Sky Survey-III project for 6 years starting in FY09. SDSS-II’s Baryon Oscillation Spectroscopic Survey (BOSS) will map the spatial distribution of luminous galaxies and quasars to detect the characteristic scale imprinted by baryon acoustic oscillations in the early universe. DOE will be a funding partner on BOSS. Funding for Research and Development (R&D) and the upgrade was provided by the DOE dark energy grants program in FY07 and FY08. Current planned funding for operations is approximately \$3M/year but will be revisited once the FY09 budget has been passed.

The Very Energetic Radiation Imaging Telescope System (VERITAS) is a major ground-based gamma-ray observatory with an array of four 12m optical reflectors for gamma-ray astronomy in the GeV - TeV energy range. VERITAS construction was a three way partnership between NSF Division of Astronomical Sciences (NSF/AST), NSF Physics Division, and DOE/HEP with contributions from the Smithsonian Institution. VERITAS operations is a partnership with NSF/PHY, DOE/HEP and Smithsonian Institution. Even though VERITAS has been in full operation for two years, the construction phase is not complete. There are plans to move Telescope #1 to a better location at Whipple Observatory and also build a central control building. AST will remain involved while the projects complete the effort of making the Whipple base camp the permanent site for VERITAS.

Kovar noted that for small projects, joint proposals are submitted to DOE by principal investigators. For larger projects, Memorandum of Understanding (MOUs) between agencies are used.

Rieke asked what boundaries are there between particle physics and particle astrophysics. Kovar replied that NSF and DOE drafted a charge to the HEPAP to look at opportunities and give priorities within three budget levels that would call out particle physics and particle astrophysics

Joseph Dehmer provided an overview of the astroparticle physics projects that the Physics Division supports. Some of those joint projects with DOE include the Deep Underground Science and Engineering Laboratory (DUSEL), the Pierre Auger Cosmic Ray Observatory, and Daya Bay. Dehmer commented that all of the projects supported by the Physics Division are interested in upgrading to the next step. These projects will be discussed in a HEPAP study.

Blandford asked how the HEPAP study committee would be selected and what the timeframe was for reporting. Kovar replied that the potential chair of the study committee has been identified and the reporting timeframe will be mid-August. The HEPAP study will complement the decadal survey. Blandford further asked whether it would be possible to separate the search for fundamental physics, dark energy, etc from other other sources seen by other telescopes. Kovar replied that DOE would need to look at all opportunities that are relevant, especially if DOE resources are being used.

Freedman commented that some ideas will work well. If the rankings are different with the separate reports, then there will need to be some adjustments. Blandford noted that these adjustments would be addressed on a case-by case basis.

#### **MEETING ADJOURNED AT 10:30 AM AND – RECONVENED AT 10:45 AM**

Craig Foltz provided an overview of the NSF and NASA joint projects (see presentation for detail). The Virtual Astronomical Observatory (VAO) is a follow-on to the very successful National Virtual Observatory (NVO). The NS/NASA MOU was signed in August 2007 and the solicitation was released in January 2008. The deadline for proposals was April 2008. A review of the proposal has been completed and interagency discussions are underway with a draft cooperative agreement completed. Funding for the project will be dependent on working out the details of the agreement between the agencies and the project.

The NRC is conducting a review NASA's report to Congress on the detection and mitigation of Near-Earth Objects (NEOs). The study is chaired by Irwin Shapiro with co-vice chairs Michael A'Hearn and Faith Vilas. A report is expected in December 2010. The report will include hazard mitigation strategies, and the role of existing and planned ground-and space-based facilities

(including NSF's Arecibo Observatory and LSST) in meeting NASA's Congressional mandate of detecting 90% of the potentially-hazardous objects by 2020.

The Planetary Sciences Decadal Survey is underway. NASA will be the lead in sponsoring the survey and NSF/AST will be a co-sponsor. The survey will be formally kicked-off in July 2009.

Vernon Jones provided an overview of the NASA and NSF joint Balloon program and the suborbital program (see presentation for details). There has been a very successful relationship between NASA and NSF's Office of Polar Programs (OPP) for many years for the balloon program. Two missions, the Antarctic Impulsive Transient Antenna (ANITA) and the Cosmic Ray Energetics and Mass (CREAM), are two such missions. Both were successful. The Super Pressure Balloon test flight met all of its comprehensive success criteria and achieved a new NASA flight duration record of more than 42 days. The Suborbital programs have offered flight opportunities for unique science investigations that require or can be done in near space. They have played an important role in maturing bench top technologies to space readiness levels.

Vladimir Papitashvili provided an overview of the NSF Polar programs (see presentation for detail). There are several astronomy and astrophysics programs at the Antarctic including IceCube, the 10-m submm-wave South Pole Telescope (SPT), the gravitational wave Background Telescope (BICEP), and others. IceCube had an excellent austral summer season and operations and science research are fully underway. SPT has concluded its second year of operations. The first major scientific results from the SPT initial survey were released in October 2008. BICEP produced cosmic microwave background (CMB) polarization maps of unprecedented sensitivity, achieving noise levels well below 1 mk in 1x1 deg pixel. BICEP2/SPUD will be deployed in December 2009. The Australian PLATO project on Dome A is a joint Australian, Chinese, and US project that includes site testing instruments and telescope arrays.

Activities at the South Pole and McMurdo Station all require significant logistical support, expensive maintenance and operations funding, and extensive data transmission for the projects.

#### **ADJOURNED AT 12:00 PM – RECONVENED AT 1:15 PM**

The next session was with Roger Blandford, the chair of the decadal survey committee. The Chair thanked him for providing an update on the decadal survey activities. Blandford briefly outlined the membership of the Committee, subcommittees, panels, and study groups. The Committee will be engaging the community in the decadal survey process and will have much contact with the AAAC during the next 2 years. The Astro2010 committee will survey the field of space- and ground-based astronomy and astrophysics, recommending priorities for the most important scientific and technical activities of the decade 2010-2020. The committee, through its subcommittees, has issued a series of calls for information including a notice of interest from activities, science white papers (over 320 papers), state of the profession papers, and technology development white papers. Future calls will include requests for information from activities. The schedule and milestones are provided on the web site, [www.nationalacademies.org/astro2010](http://www.nationalacademies.org/astro2010).

Stassun commented that the AAAC might have a better perspective or advantage point when it comes to interagency activities and this might be a way for them to advise the decadal survey in studying these activities. The AAAC might be able to communicate the time costs associated with moving these interagency projects forward. Blandford noted that it was not just time but money that was involved in the process. The Agencies all have different management styles but the AAAC could be a go-between with the Agencies and the decadal survey.

Balick asked whether there would be a liaison to keep the panels and the committees informed about what is going on in the community and at the Agencies. Blandford replied that he is personally being kept informed and the Agencies would be ones to inform the panels or subcommittees of any changes. He also noted that representatives from the NASA Advisory Council (NAC) and HEPAP were at the last Decadal Survey Committee meeting.

Koo asked how the community was going to balance the issue of excellence versus having the U.S. as the lead, especially in large projects; the U.S. may be left out because of the way it prioritizes projects and the lengthy process. Blandford replied that the survey will make recommendations that might seem as a partnership versus U.S. going it alone, but that is not the case. There will be complementarities. Koo further asked whether science leadership would be the only requirement. Blandford replied that choices would need to be made on medium and large missions and that most large projects are collaborative. Balick noted that international collaboration was important and Blandford further noted that the survey would provide a set of principles that the Agencies would use when working on international projects.

The Chair thanked Blandford and Moloney for their participation and update.

Wayne Van Citters provided an overview of the Mathematical and Physical Sciences (MPS) Facilities Planning exercise (see presentation for details). MPS must develop a Facilities plan because project costs are outpacing divisional budget growth. Concepts for these projects are stretching 10-15 years and if MPS does not do careful planning, these projects will not happen at all. MPS must design and use a process of active life-cycle management which actively plans from concept to closure of the facility. The current inventory of facilities must be regularly evaluated and tracked during the planning, development, and construction stages. MPS must take into account all projects under development and must ensure that it can follow through on what is started—build, maintain, and use the facilities effectively. MPS started the planning process with a draft of the plan that was presented to the MPS Advisory Council (MPS AC) in November. The MPS Program Officers Working Group have been working out the details of the plan and have refined the tracking tools to be used. The plan was discussed with the NSF Major Research Equipment and Facilities Construction (MREFC) Panel in January and with the AAAC at this meeting. The prioritization process will begin in March and will be discussed with the MPS AC again in April 2009.

The MPS strategic co-investment model will balance opportunities across divisions and will minimize impact on core programs; it will not just be for facilities. The model will also provide budget stability and long-term commitment and will allow build-up of budgets for strategic initiatives beyond a single division's capability.

Lester asked that if the document is a living document, how will MPS assess the process from year to year. Van Citters replied that proposals would be reviewed as they are submitted, as they go through the decadal survey, as they go from one stage to the next, and then as they go to the MPS Assistant Director for assistance in funding. These proposals will be reviewed at all stages of the process.

Weinberger asked whether there were other Directorates who were doing a similar planning exercise? Van Citters replied No. MPS was the only Directorate doing this type of planning for their facilities.

Lester asked what would happen if the MPS Divisions did not receive the 6% budget growth. Van Citters replied that adjustments would be made.

The chair thanked Van Citters for his participation.

Mark Coles, Deputy Director of the Large Facilities Projects Office (LFPO) in the Office of Budget, Finance, and Award Management (BFA) gave an overview of NSF's Large Facilities portfolio and pre-construction planning process (see presentation for details). The FY2009 budget request for major multi-user facility operations is about \$1106 million, or about 16% of the NSF Budget Request. The FY2009 budget for major facility construction is ~\$148M, or about ~2% of the NSF's annual budget; that 2% attracts a lot of attention. There are three projects pending construction in the MREFC account and one candidate for future construction, the Advanced Technology Solar Telescope (ATST). There are some remaining issues that need to be resolved for ATST before it moves forward into the MREFC queue. The FY2009 budget request introduced a new change to the MREFC process, a "no cost over-run policy." The policy requires that the cost estimates at Preliminary Design Review (PDR) have adequate contingency to cover all foreseeable risks, and any cost increases not covered by contingency be accommodated by scope reduction. There are many concerns with the current MREFC process which limit the ability to plan adequately, including the availability of adequate funding for pre-construction development and National Science Board (NSB) involvement in selection/prioritization after Conceptual Design Review (CDR). Operating costs are a limitation factor for NSF to take on new construction and it is very hard to terminate currently operating facilities.

Kolb noted that partnerships were important but how does one connect that to the policy of "no cost overruns." Kovar also asked whether the no cost overrun policy really had substance, since ALMA was rescope and rebudgeted. Coles replied that he thought the NSF Director meant what he said and was trying to convey a message to the community on the need for comprehensive, risk-based planning to define future construction budget requests.

The chair thanked Coles for his participation.

The next session was with the Office of Science and Technology Policy's (OSTP's) John Henry Scott. Scott informed the Committee that the OSTP Director (John Holdren) had not yet been confirmed by the U.S. Senate nor had the four Associate Director positions been filled. He also informed the Committee that this would be his last meeting as the OSTP representative; he would be returning to his job at the National Institute of Standards and Technology (NIST) in a few weeks.

Koo asked if there were any projects that would be protected. Scott replied that there was going to be a re-examination of the state of all of the projects. The National Science and Technology Council (NTSC) subcommittees are being reviewed and their charters re-examined and possibly updated.

Weinberger asked whether the reports were useful to him and to OSTP. Scott replied that the reports were very valuable to him. They have provided a view by the science community on what was or was not working well at the agencies. He added that the reports provide communication for those who are arguing on the community's behalf and that the reports did not need to be so technical that they were not understood.

The Chair thanked Scott for his participation.

**ADJOURNED AT 3:15PM – RECONVENED AT 3:30 PM**

The next session was a discussion of AAAC report issues. The Chair noted that the report needed to focus on interagency projects. There is a lot of planning on the part of the Agencies to get those collaborations underway and going well. Turner added that the report needed to be short and to the point and like the Chair said, focus on interagency projects.

The Chair asked the Committee and the Agencies how the AAAC could be more proactive with the community. Scott replied that if the science appears to be ambiguous but really is not, then the committee needed to look at this because they are the experts. Foltz replied, for instance, if LSST rose to the top of the priority list but the NSB did not view the project as a top priority, then it would be beneficial for the AAAC to have positive statements about the project and its importance to the science.

An action to NSF from the Committee was to provide them with a list of interagency projects.

The Chair informed the Committee that there would be two meetings by teleconference and one more face-to-face meeting in 2009. The proposed set of meeting dates are a March 5 teleconference to discuss the annual report; April 30 teleconference; and, October 15-16. Freedman asked the Committee and Agencies place these dates on their calendars. Rieke informed the Committee that she would rotate off this year.

**MEETING ADJOURNED AT 5:10 PM EST, 18 FEBRUARY 2009**

**MEETING RECONVENED AT 9:00 AM EST, 19 FEBRUARY 2009**

The Chair called the meeting to order. The Committee continued discussions on the structure of the report. Sections will include a science overview, a context statement, the charge, a summary status of projects from the last decade survey, and interagency projects and issues. The Committee reviewed the list of major projects from the last decadal survey and those projects that were a carryover from the 1990 decade survey. The broad scope of the report will have general observations of how the last decade survey went as well as observations on the remarkable successes in the science over the past decade. There are a lot of positives associated with the past decade, i.e., the Telescope System Instrumentation Program (TSIP), the GLAST launch, advancement of the James Web Space Telescope (JWST), and significant technical developments on NVO, to name a few. Those projects that have not been done will be re-prioritized in this decade survey.

**ADJOURNED AT 10:25 AM – RECONVENED AT 10:40 AM**

The Committee continued their discussions on the structure and content of the annual report.

**ADJOURNED AT 12:00 PM – RECONVENED AT 1:15 PM**

The Chair made writing assignment and the Committee dedicated the remainder of the meeting to writing a draft of the annual report due 15 March 2009.

**MEETING ADJOURNED AT 3:00 PM EST, 19 FEBRUARY 2009**