Minutes of the Meeting of the Astronomy and Astrophysics Advisory Committee

5–6 February 2004
NASA Headquarters, Washington, DC

Members attending:	Robert Gehrz (Chair)	Rene Ong
	Neta Bahcall	Bradley Peterson
	Alan Dressler	Catherine Pilachowski
	Robert Kirshner	Abhijit Saha
	Barry LaBonte	Mark Sykes
	Angela Olinto	
Agency personnel:	Wayne Van Citters, NSF	Jeffrey Hayes, NASA-OSS
	Eileen Friel, NSF	Lou Kaluzienski, NASA-OSS
	Dana Lehr, NSF	Lindley Johnson, NASA
	Vernon Pankonin, NSF	Tom Morgan, NASA
	Vladimir Papitashvili, NSF	Farid Salama, NASA-ARC
	Elizabeth Pentecost, NSF	Edward Weiler, NASA-OSS
	Randy Phelps, NSF	Chris Wilkinson, NASA-OSS
	Nigel Sharp, NSF	Robin Staffin, DOE
	Marc Allen, NASA-OSS	Kathy Turner, DOE
	Dan Blackwood, NASA	Amy Kaminski, OMB
	Denis Bogan, NASA	Joel Parriott, OMB
	Tom Greene, NASA	David Trinkle, OMB
	Paul Hertz, NASA-OSS	Patrick Looney, OSTP
Invited speakers:	Wendy Freedman, Carnegie Observatories	
Other participants:	Henry Ferguson, STScI	

MEETING CONVENED 9:00 AM EST, 5 FEBRUARY 2004

Dr. Paul Hertz opened the meeting and all participants introduced themselves. The Chair led a discussion of Committee structure, including Chair elections, term limits and a draft schedule for the expiration of current member appointments. Consensus was reached to implement the following Committee structure:

- Each member will serve a maximum of two consecutive three-year appointments.
- Terms run from March 15 to March 15 of each calendar year to align with the annual report submission deadline.
- Members will elect a Chair and Vice-Chair, each of whom will serve a two-year term (with an option to step down after the first year).
- Current appointments will end on a staggered schedule in which the numbers of agency (NSF, NASA, OSTP) appointments in any given year are reasonably balanced.

The current Chair elected to end his term on March 15 in response to increasing time commitments related to the recently launched Spitzer Space Observatory. Committee members and agency personnel extended their thanks to the Chair for his valuable leadership and service

during the inaugural year of the AAAC. Chair and Vice-Chair elections were postponed to the morning of 6 February.

Dr. Wayne Van Citters reviewed the status of NSF programs and planning, including grant programs, budget histories and forecasts, national facilities and the status of large projects identified by the 2001 National Research Council (NRC) Decadal Survey such as the Advanced Technology Solar Telescope (ATST), the Atacama Large Millimeter Array (ALMA), the Large Synoptic Survey Telescope (LSST), the Giant Segmented Mirror Telescope (GSMT) and the National Virtual Observatory (NVO). Dr. Van Citters also described the current status of the NSF-NASA-DOE National Science and Technology Council (NSTC) Interagency Working Group (IWG) charged with producing a reply to the NRC study "Connecting Quarks with the Cosmos" (Q2C). The IWG has completed its draft report, which is undergoing approval and clearance processes at the participating agencies.

A comparison of the budget projections demanded by the 1991 and 2001 Decadal Surveys demonstrated a dramatic discrepancy between the levels of financial support required to implement each survey's recommendations. In response, the Committee discussed potential mechanisms to develop more proactive planning and implementation processes that would be based in part on the recommendations of the 2001 Decadal Survey and other reports. Dr. Illingworth questioned how NSF would solicit community input to a strategic planning process for astronomy and astrophysics. Dr. Van Citters noted the lack of an NSF advisory body that reports solely to the Division of Astronomical Sciences (AST) and suggested that the AAAC would be an important conduit of input. He also offered that the AAAC might convene ad hoc subcommittees, task forces or workshops that could address specific issues. Dr. Dressler noted that the 2004 NRC report "Setting Priorities for Large Research Facility Projects Supported by the NSF" (a.k.a. the Brinkman report) recommended that NSF should convene workshops and/or ad hoc groups at the directorate level to solicit broad input from the scientific community as a basis for a roadmap for large research facility projects.

The Committee also noted that while private-public partnerships have become common for large projects, NSF has not yet developed a process for considering the role of private contributions in priority setting and planning. Dr. Olinto specifically questioned how NSF would respond to a private contribution to a low-priority project, to which Dr. Van Citters responded that considerations of other priorities and the project's science case may require NSF to decline the private funding.

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

Dr. Paul Hertz presented an update on NASA programs. Gravity Probe B (GPB) experienced a launch slip to mid-April due to a spacecraft issue; the instrument is working beautifully. The Swift observatory is scheduled for launch in September. The Space Interferometry Mission (SIM) and the James Webb Space Telescope (JWST) have both passed initial confirmation review to enter Phase B, and the Gamma Ray Large Area Telescope (GLAST) has passed confirmation review to enter Phase C/D.

Dr. Hertz outlined the goals, objectives and implementation strategies of the President's new Vision for Space Exploration, which generated considerable discussion over its impact on NASA science. Dr. Hertz noted that the new vision is "exploration-driven" and enables science rather than being "science-driven". Future evaluations of Exploration missions will require exploration and technology demonstrations; science will be incidental to technology. Former Secretary of the Air Force Pete Aldridge will lead a new commission, known as the President's Commission on

Implementation of United States Space Exploration Policy, to evaluate NASA's organization and management in support of the new exploration-driven goals.

Dr. Hertz next reviewed major changes in each of the Space Science Themes. The Hubble Space Telescope (HST) Servicing Mission 4 (SM-4) has been cancelled due to safety considerations following the loss of the Space Shuttle Columbia. NASA will continue to examine ways to extend the observatory's operational life without additional servicing missions. The JWST funding profile has been shifted forward, and the budget is now fenced. The Laser Interferometer Space Antenna (LISA) has been delayed an additional year (now with a 2013 planned launch date), and Constellation-X (Con-X) has been delayed two years. The Einstein Probes (including the Inflation Probe, Dark Energy Probe and Black Hole Finder Probe) have been deferred indefinitely but not cancelled. The Mars Exploration Program has been significantly augmented, and Lunar Exploration has been added as a new Space Science Theme managed by the OSS Solar System Exploration Division.

The Committee considered its potential contributions to a reconsideration of the HST SM-4 cancellation and to the NASA road mapping process. During the Committee's discussions, Dr. Hertz noted that the scientific community needs to consider what science cannot be done without the capabilities of HST and whether that science is of higher priority than other capabilities that we want to develop with fixed resources. Dr. Hertz offered that Dr. Ed Weiler, Associate Administrator of NASA's Space Science Enterprise, might be available to address the Committee's questions during the afternoon session.

MEETING ADJOURNED AT 12:15 PM – RECONVENED AT 1:10 PM

Dr. Patrick Looney reviewed the nation's historical research and development (R&D) spending trends and described the history of large-scale science (LSS). LSS has been traditionally the realm of high-energy physics, nuclear physics, astronomy and space science; however, emerging fields have offered increased competition for LSS projects. Dr. Looney noted that recommended scientific research facilities outpace the most optimistic budget scenarios by factors of 2–4 and that budget submissions tend to neglect the impact on related programs and activities of other agencies. In short, "We are in danger of saturating our available budget with low priority, redundant and/or uncoordinated activities." Dr. Looney suggested that LSS projects must be subordinated to a broader view of science and that better, more critical, more broadly coordinated advice is needed on priorities "across the government".

Dr. Looney reviewed the status of the NSTC IWG on the Physics of the Universe. The IWG has completed a draft of its report, which has passed all agency clearance processes; the group is now readying the final version of their report in preparation for the internal OSTP/OMB final clearance process.

Dr. Looney presented a set of questions that must be addressed in planning discussions of ground-based astronomy, particularly as impacted by NASA's new exploration vision. Dr. Looney predicted an upcoming phase transition for ground-based telescopes as the cost, political capital and visibility of large projects increase. He emphasized the need for community consensus in identifying the need, implementation plan and international context for large projects and noted that, while public-private partnerships may increase the feasibility of large projects, "we don't know what they look like."

Dr. Ed Weiler next offered his view of NASA's new exploration vision and addressed the Committee's questions. Dr. Weiler noted that planetary science now constitutes over half of all

OSS spending since Lunar Exploration will reside in OSS. In responding to the Committee's questions regarding the projected fate of HST, Dr. Weiler offered that Goddard Space Flight Center (GSFC) would consider alternative power management strategies to extend battery lifetimes. Dr. Weiler expressed optimism that under the President's new vision NASA can be co-driven by exploration and science, and he noted that the budget and planning processes must be re-developed now that a new philosophical vision for NASA has been set.

Dr. Robin Staffin next reviewed the major program thrusts and scientific questions of the DOE Office of Science High Energy Physics (HEP) Program, which houses the majority of DOE astronomy- and astrophysics-related research. Dr. Staffin overviewed the FY 2003, 2004 and 2005 HEP budgets, described how DOE selects and conducts research, and discussed large projects that DOE supports (or will consider supporting) in cooperation with NASA and/or NSF, including LSST, GLAST, the Joint Dark Energy Mission (JDEM), the Pierre Auger experiment, and the Very Energetic Radiation Imaging Telescope Array System (VERITAS).

Dr. Pilachowski asked Dr. Staffin to describe the path to development of interagency projects. Dr. Staffin called on Dr. Kathy Turner, who offered the example of GLAST, in which the collaboration grew from a particular proposal. Dr. Hertz clarified that GLAST was first developed conceptually and then competed in an Announcement of Opportunity (AO); DOE offered to partner with NASA if a particular proposal was selected during the resulting competition. Dr. Hertz continued to offer that the JDEM model for interagency collaboration will differ in that co-funding will be determined in advance of project design selection and the proposal competition will be managed cooperatively. Dr. Van Citters and Dr. Friel noted that a joint review process between NSF and DOE already exists before downselection. Dr. Ong added that strong coordination between NSF and DOE is a recent development during the past 3–4 years. Dr. Hertz offered that coordination must be developed within agency-specific processes, and Dr. Looney suggested that JDEM will be an interesting experiment in interagency coordination and joint project management.

Dr. Hertz then described existing interagency plans for JDEM. He briefly reviewed dark energy science and noted that both the NRC Q2C report and the report of the IWG on the Physics of the Universe recommend that NASA and DOE cooperate to construct a dark energy experiment. Dr. Hertz described the DOE/NASA process for cooperation that has been endorsed by both agencies and outlined the JDEM management and science components. Dr. Hertz also reviewed a preliminary assignment of funding responsibilities, notional organization chart and straw man schedule for JDEM (in which Year 0 is identified by new funding, expected no earlier than 2010, and launch is expected no earlier than 2021). Dr. Hertz identified challenges of the JDEM plan, which include coordination of required resources, aligning different management structures and working with two different scientific communities with different cultures, vocabularies, expectations and priorities. Finally, Dr. Hertz offered that the DOE/NASA GLAST collaboration has offered considerable experience to draw upon and that the agencies have worked well together thus far.

The Committee lauded the agencies' cooperation thus far and assessed the plan outlined by Dr. Hertz as positive. The Committee asked Dr. Hertz what advisory role the AAAC could play in JDEM. Dr. Hertz responded that the AAAC should ask if JDEM still addresses high-priority science and could offer advice on improving both near-term and long-term planning processes. Dr. Dressler identified a need to consider the option of ground-based efforts that could address the dark energy question. The Committee agreed that a Scientific Definition Team should establish requirements of a dark energy experiment and then assess how best to accomplish those requirements. NSF should contribute co-funding to a concept study to identify the tradeoffs of

ground-based and space-based dark energy experiments. Dr. Papitashvili asked if a long-duration ballooning (LDB) experiment might be a feasible option for a dark energy mission. Dr. Hertz noted that the NASA LDB AO is open to dark energy science.

MEETING ADJOURNED AT 3:50 PM – RECONVENED AT 4:05 PM

Dr. Nigel Sharp described interagency plans for a Cosmic Microwave Background (CMB) roadmap, which was promised by the joint agency response to the Q2C report. NSF leads the IWG for CMB polarization studies, which plans to form a task force on the Future of CMB Research (TFCR). The TFCR will be led by a neutral chair and will hold a workshop (potentially in the summer of 2004) to solicit broad community involvement. The TFCR report should identify the most important technologies and critical gaps and should sequence technical milestones of ground-, balloon- and space-based experiments. The proposed timeline provides IWG recommendations by early 2005 that will potentially provide input to the FY 2007 budget.

Discussion of Committee business followed. The minutes of the 3 November 2003 teleconference were approved without revisions. Committee members were reminded of the planned 8 March teleconference to discuss a draft of the AAAC annual report due 15 March.

The Committee discussed their annual meeting schedule; a draft schedule was identified in which the Committee would meet three times for general discussion in May/June, October/November and early February. A fourth teleconference in early March will be held to finalize the Committee's annual report. Chair and Vice Chair elections will be held biannually (or annually when necessary) during the February meeting.

MEETING ADJOURNED AT 5:30 PM, 5 FEBRUARY 2004

MEETING RECONVENED 8:15 AM EST, 6 FEBRUARY 2004

The Chair convened the Committee and called for elections of the new Chair and Vice Chair, who will begin their terms on 15 March. Committee members identified nominees, who accepted or declined to serve; nominations were followed by secret ballot. The Committee elected Dr. Illingworth as Chair and Dr. Carlstrom as Vice Chair.

Dr. Van Citters reported that Dr. Michael Turner would not address the Committee today because of illness.

Dr. Wendy Freedman reported on the activities of the NRC Committee on Astronomy and Astrophysics (CAA) and on the status of the Decadal Survey. Dr. Freedman described the overall objectives and nature of the CAA and identified the current membership. She reviewed the components of the 2001 Decadal Survey that impact both NSF and NASA planning. Laboratory astrophysics and theory programs were identified as areas that require particular attention. Dr. Freedman noted that the 2001 Decadal Survey was particularly ambitious; its recommendations implicitly assumed that the NSF budget would double in the coming decade.

Dr. Freedman also described ongoing and upcoming issues for the CAA. These included the publication of a briefing booklet on the origins of stars, planets and galaxies aimed towards a general audience, discussion of NASA theory programs (particularly as related to JWST), consideration of the NASA Einstein Probes (including JDEM) and the Terrestrial Planet Finder (TPF), and the prioritization of projects in light of both NASA's new exploration vision and the cancellation of HST SM-4. Dr. Freedman also noted the growing increases in the magnitude and

scope of projects undertaken by NSF, which will require proactive strategic planning in addition to NSF's more traditional responsiveness to proposals. She noted that the current budget constraints are very challenging at both NSF and NASA, and that the nature of private-public partnerships needs to be addressed as an increasingly relevant consideration for large projects.

Dr. Freedman then responded to questions from the Committee. Dr. Pilachowski asked what would be considered the metric of success for theory programs. Dr. Freedman responded that new funding is needed at levels commensurate with other programs and that theory should be integrated into project and mission planning. Dr. Freedman offered the Wilkinson Microwave Anisotropy Probe (WMAP) as a model for the latter recommendation.

Dr. Kirshner asked what concrete activities the AAAC can undertake in relation to the CAA. Dr. Freedman offered that, while CAA prioritizes only science, the AAAC can provide tactical advice on the implementation of those priorities when all other issues and stakeholders are considered—including politics, policy, technological readiness, budget constraints and funding profiles. She added that the AAAC could also serve as a fast-acting advisory body; in contrast, the CAA requires extensive NRC review for all of its formal reports and responses. Dr. Gehrz summarized Dr. Freedman's response by describing the AAAC as the "tactical arm" of the astronomy and astrophysics advisory structure. Dr. Freedman also noted that the CAA prioritizes ground- and space-based projects separately and does not provide advice on interlacing these activities. Dr. Van Citters emphasized that the NSF needs timely advice to develop an integrated strategy to implement the Decadal Survey, particularly because the budget constraints are "very serious." Dr. Freedman agreed and noted that NSF does not have a separate funding mechanism to provide extensive funding for technology development; projects competing for MREFC funding must be "ready to go."

Dr. Vernon Pankonin next overviewed NSF's support for planetary sciences. Dr. Pankonin described the existing programs that support planetary sciences at NSF, which lie primarily in the Division of Astronomical Sciences (AST), the Directorate for Geosciences (GEO), and the Office of Polar Programs (OPP). For the Planetary Astronomy Program in AST, Dr. Pankonin presented the funding profile, success rates and numbers of proposals for 1993–2003, as well as the profiles for active awards according to technique and type of awardee institution. Dr. Pankonin also reviewed special opportunities in the planetary sciences that instigated or allowed particular collaborations with NASA and/or other NSF directorates. Future initiatives at NSF might include competitive grant programs in comparative planetary atmospheres (potentially co-funded by AST and the Division of Atmospheric Sciences in GEO) and astrobiology (in cooperation with the NSF Directorate for Biological Sciences), as well as funding for LSST.

Dr. Lindley Johnson followed with a description of the NASA Planetary Astronomy (PAST) Program. Dr. Johnson reviewed the NASA Research Announcement (NRA) program criteria and presented the program's 15-year historical and projected funding profile as well as the program balance by study area. The program includes support for the Infrared Telescope Facility (IRTF), which receives additional funding from NSF for instrumentation and guest observing. Dr. Johnson also discussed the future of PAST ground-based facilities (particularly in the post-Cassini era) and reviewed the objectives, average yearly funding level and study areas of the separate Planetary Atmospheres (PATM) program managed by Dr. Denis Bogan.

Dr. Johnson suggested that an NSF/NASA cooperative effort could enable a targeted search for accessible Kuiper Belt Objects (KBOs) with the objective to identify a post-Pluto mission target. Dr Johnson also discussed the Near Earth Object Observations (NEOO) Program, for which the scientific objective is to discover 90% of all NEOs larger than 1 kilometer in size by 2008. Dr.

Dressler inquired about the relation of LSST to NEOO, to which Dr. Johnson responded that the Congressionally mandated 10-year timescale for NEOO precluded LSST involvement.

Dr. Farid Salama next presented an overview of the findings of the NASA 2002 Laboratory Astrophysics Workshop, which assessed the role that laboratory astrophysics plays in the optimization of NASA missions. (Committee members received a draft copy of the workshop report prior to this meeting.) Dr. Salama emphasized that the current funding profile for laboratory astrophysics cannot meet the needs of existing NASA missions or adequately prepare for future missions. He noted that the compilation of databases is a high priority need and that existing laboratory astrophysics facilities are aging. Workforce retention and development were also identified as critical needs. Dr. Salama reviewed the needs for laboratory data that would support specific missions and spectral bands, and he offered that the capabilities of planned missions exceed current laboratory knowledge in areas such as cold plasmas, nanoparticles, and atomic transition rates and cross-sections. The workshop report concluded that a vigorous laboratory astrophysics program should integrate theory, modeling and experiment.

The Committee followed Dr. Salama's presentation with a discussion of how to prioritize and strategically plan for needs in laboratory astrophysics. The Committee agreed that the existing facilities and workforce must be identified to allow an informed discussion.

Dr. Friel reviewed the existing NSF support for laboratory astrophysics research, which is integrated within the Astronomy and Astrophysics Research Grants program. She reported that NSF receives only a handful of laboratory astrophysics proposals per year across a range of subjects with astrophysical relevance. Dr. Friel offered examples of active laboratory astrophysics awards and noted that other divisions at NSF (particularly Physics and Chemistry) also support laboratory astrophysics research.

Dr. Hertz, Dr. Van Citters and Dr. Friel agreed that the success rates of laboratory astrophysics proposals are similar to other disciplines and programs, which seems to indicate that current proposal pressure is being met. Dr. Illingworth inquired if international facilities for laboratory astrophysics could be leveraged, to which Dr. Van Citters responded that scientists may propose to NSF for support to perform research at international facilities. Dr. Friel offered that the NVO team is investigating how to incorporate theory, modeling and simulations into the NVO framework and that laboratory astrophysics databases could be included in the planning. The Committee agreed to revisit the discussion of laboratory astrophysics needs at their next meeting.

Dr. Marc Allen reviewed the purposes and processes of NASA Enterprise Strategic Planning and described the 2003 Strategic Management Principles. Dr. Allen noted that the research community plays a critical role in guiding NASA's space science program via the NRC Space Studies Board, the NASA Space Science Advisory Committee and its subcommittees, and NASA peer review and senior review processes. Dr. Allen offered his perspective of NASA's new exploration vision and noted that "non-exploration" science will experience static or slower growth. Dr. Allen also noted that while the new vision expresses preference for "exploration" science, "OSS will still start with the best science." Dr. Allen compared the 2003 Space Science strategic planning process with a notional process and FACA committee structure for 2006 strategic planning that will respond to the new vision for NASA.

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

For the remainder of the meeting the Committee discussed a draft of their annual report.

MEETING ADJOURNED AT 3:00 PM, 6 FEBRUARY 2004