

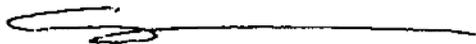
National Aeronautics and Space Administration

**NASA ADVISORY COUNCIL [NAC]
ASTROPHYSICS SUBCOMMITTEE**

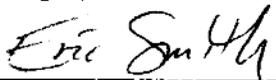
January 28-29, 2008

NASA Headquarters
Washington D.C.

MEETING REPORT



Craig Hogan, chair



Eric P. Smith, executive secretary

Report prepared by
Mark Bernstein
Harris Technical Services
February 12, 2008

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AGENDA

Astrophysics Subcommittee Meeting
January 28-29, 2008
NASA Headquarters 300 E Street SW
Washington DC, 20546
Room 3H46

Monday, January 28, 2008:

8:30	Coffee and Conversation	
9:00	Welcome/Administrative Matters	Craig Hogan
9:10	Astrophysics Division Update	Jon Morse
10:00	Discussion	All
10:30	Break	
10:45	ExoPlanet Task Force Briefing	Heidi Hammel
11:15	Discussion	All
12:00	Lunch	
1:00	Keck Time Usage Discussion	Zlatan Tsvetanov
1:30	Science Mission Directorate Update	Alan Stern
2:30	Discussion	All
3:00	BEPAC Report	Charles Kennel (via speaker phone)
4:00	Astrophysics Division R&A Status	Wilton Sanders
5:30	Adjournment	

Tuesday, January 29, 2008:

8:30	Coffee and Conversation	
8:45	SMD level R&A issues and E/PO	Yvonne Pendleton
9:30	Astrophysics Division EPO Update	Hashima Hasan
10:30	Discussion	
11:00	Science Planning Discussion Update	Eric Smith
11:15	Subcommittee Discussion	All
12:00	Lunch	
1:00	Subcommittee Membership News	Eric Smith
1:30	Discussion and Letter Writing	All
2:30	Break	
2:45	Letter Writing, continued	All
4:00	Adjournment	

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INTRODUCTION

Craig Hogan, chair, convened the session Monday, January 28, 2008 at 9 a.m. Hogan welcomed all present, noting that it was the first meeting at which he would serve as chair. Eric Smith noted that this was a FACA [Federal Advisory Committee Act] meeting; therefore, persons not Subcommittee members who wished to speak must first be called upon. Subcommittee members introduced themselves.

* * *

ASTROPHYSICS DIVISION UPDATE

Jon Morse
Astrophysics Division Director

Jon Morse noted that, by requirement, the Subcommittee was meeting in advance of the NASA Advisory Council [NAC] session, which itself was meeting the day prior to the release of the President's FY'09 budget. No information on the FY'09 budget could, therefore, be made available to the Subcommittee.

Slide #2: Astrophysics Division: Current Assignments

Jon Morse presented a divisional organization chart, noting the many individuals were new to their assignments. He characterized mission staff as the 'eyes and ears' of headquarters; as such, they were the main points of interaction with the community.

Slide #3-4: Astrophysics: Potential Reorganization

Jon Morse described his intended division reorganization; its main purpose was to reestablish the intellectual foundation for astrophysics. At present, he noted, four programs had only one mission each; this, he said, created managerial difficulties. He believed program areas should be science based, with multiple projects, coupled scientifically, in each. This arrangement, he said, would greatly facilitate forward planning. The structure he proposed was:

- Cosmic Origins
- Physics of the Cosmos
- Exo-Planet Exploration
- Astrophysics – Explorer
- Astrophysics Research

Jon Morse said these designations would provide greater transparency on Astrophysics activities; in contrast, he called attention to Navigator, saying no one unfamiliar with NASA knew what it was.

Slide #6: Astrophysics: Potential Re-Organization

Jon Morse said the proposed reorganization would aid forward planning; focus attention on the balance of technology and program, and assist with cost reserve management. At present, he said, the lack of a firm mission queue meant a change to any mission affected all. He believed projects should live within program categories, with cost management undertaken at the program level. This, he said, would mean, for example, that a potential JWST cost issue would be addressed

within its 'box,' without other efforts being raided. Morse added that, since he had become director in April 2007, numerous budget problems had arisen at the project level, with no reserves being available at that level. Jon Morse he wished to avoid the division having 'single-mission' categories.

Brenda Dingus noted that the proposed areas received widely varying levels of funds. Morse agreed; he estimated: ExoPlanet Explorations -- \$100 million [all figures in FY'08]; Cosmic Origins -- \$1 billion; Physics of the Cosmos -- \$150 million; R&A -- \$60 million. Morse said that while apportionment would shift over time, there was no intention to equalize it. The decadal survey, he said, established science priorities; budgets needed flexibility to accommodate those priorities.

Heidi Hammel noted that, at one point, each 'box' had its own R&A program; was this intended now? Jon Morse said that initially all R&A funds would be captured in a separate box; it was possible the foundation science model might be employed later. He wished to avoid 'cutting the pie too thinly'; that, if done, made it difficult to undertake significant activities.

Craig Hogan asked how the proposed structure mapped against the organization for National Academy reviews. Jon Morse noted that the division would have three science-based themes; if, he added, the Academy organized around science-based panels, it would likely have more than three. He hoped Astrophysics would have broader categories than the Academy. The central purpose of the categories was to facilitate management; each should be large enough to permit flexibility.

Slide #7: Astrophysics Division – Project News

Jon Morse reported Astrophysics 'extremely exciting' portfolio, as follows:

NuSTAR reinstated with 2011 launch date:

Jack Burns [by speakerphone] sought background on the NuSTAR selection. Morse, noting that NuSTAR history preceded his appointment, said the project had ranked first in the 2003 SMEX Announcement of Opportunity [AO]. The program had been suspended for budget reasons in 2005; a low level of NuSTAR science work had continued. Reinstatement reflected the desire of Alan Stern, associate administrator, Science Mission Directorate [SMD] to raise the flight rate; Stern, Morse said, believed NuSTAR was affordable. In summer 2007, therefore, the NuSTAR program was requested to ready itself for technical review. Morse stressed that this mission, like others, had to respect cost constraints. He noted that Stern's letter reinstating NuSTAR included several de-scopes; among them, the reduction from three to two telescopes to permit healthy reserves and schedule compliance.

Small Explorer [SMEX] AO:

Jon Morse reported thirty-three SMEX mission proposals had been received; more were anticipated. This, he added, showed the value the community placed on the Explorer program.

New Launch Capabilities: 2008 and 2009

GLAST [Gamma Ray Large Area Space Telescope] had experienced difficulties completing thermal vac testing; several schedule slips had occurred. In response, a launch date allowing sufficient time and reserves was fixed, and had been adhered to. GLAST would complete thermal vac testing in three weeks; Morse praised the Naval Research Laboratory [NRL] for 'stepping up' when the thermal vac work was reassigned to it.

HST SM4 [Hubble Space Telescope/Service Mission #4] current launch date of August 7, 2008 might slip, because of the Space Shuttle scheduling implications of

the associated Launch on Need. Morse estimated the delay at two to four weeks, depending on the refurbishing time the Shuttle required after its next flight.

Herschel Planck was going 'very well'; hardware had been delivered. The launch date had slipped from July 31 to August 31, 2008; Morse hoped to avoid further slippage.

Kepler had passed review; contractors were performing well. Current launch date was mid-February 2009.

WISE [Wide-field Infrared Survey Explorer] was at subsystem assembly level; integration and overall testing was set for the next 12-16 months.

SOFIA [Stratospheric Observatory for Infrared Astronomy] early science work has been accelerated to 2009. This acceleration followed the decision to treat SOFIA as an earth-bound telescope; that is, alternate science work and upgrades. Morse noted that when the SOFIA aircraft was flown to Ames Research Center, 3,500 people came to see it.

Jon Morse said he wished to proceed on AO solicitations for PI [Principal Investigator]-led investigations on medium-class strategic missions. Queried by Craig Hogan, Morse said these would be competed, though as PI-led science investigations; not PI-led missions. Hogan commented that JDEM [Joint Dark Energy Mission] had been described as a competition between architectures; now, it appeared an architecture had been selected and its use would be competed. Morse said that was subject to change; 'straw man' parameters would be defined to help create baseline cost knowledge. Morse said that, with medium-class missions, he wished clear mission lines with a common mechanism for competition so people would know what to expect.

Jon Morse noted that JWST [James Webb Space Telescope] would be undergoing a week-long PDR [Preliminary Design Review/NAR [National Academy Review] in spring 2008.

Slide #8: Astrophysics Mission Events

Jon Morse reported the success of there Antarctic balloon launches, and called attention to the suborbital program which, he said, received very little press attention.

Slide #10: Astrophysics Division – Project News

Jon Morse reported that ten missions would undergo Senior Review in 2008; this marked the first review of Great Observatories. Hubble will be reviewed following SM4, so that review can reference its new capabilities. Morse added that as WISE's primary science mission would last only six months, it might be appropriate for Senior Review in 2009. Queried by Craig Hogan, Morse said SOFIA would enter Senior Review after it had initiated science operation.

Andrew Lange noted that Senior Review had become highly important; had a chair been chosen? Jon Morse noted that panel members were not identified in advance, to prevent lobbying on behalf of particular projects. The Senior Review, Morse noted, would address \$150 million in assets; a 'decadal quality' panel was intended. Morse noted that the panel's key question was not: is this project doing good science? But: is this science worthwhile compared to other possible expenditures?

Kathryn Flanagan asked if all Great Observatories would ever be reviewed simultaneously. Morse said plans were to review each biennially; however, a synchronized review could be held if this appeared advantageous. Of the Great Observatories, Morse noted that Spitzer was exhausting its cryogenics. Chandra, he said, may be able to continue operating for decades; the issue for review was whether its science productivity was commensurate with its cost. Morse repeated

the central question: could something better be done with funds an operating project was using? Belinda Wilkes asked how one could compare the value of what one was doing with the value of something one might do.

Slide #11: Strategic Investments in Research and Analysis

Jon Morse stated he intended to re-invigorate the suborbital programs, both for science involved and as 'on ramps' for PI training. He noted the restoration of full funding for the FY'08 Astrophysics Theory grants. Morse noted receipt of 42 proposals for Strategic Mission Concept Studies; eight to ten would be selected, with technical assessments made in preparation for the Decadal Survey. In aggregate, Morse noted the proposals sought approximately \$40 billion – equal to the Astrophysics budget through 2050.

Slide #12-13: Astrophysics Fellowships:
Named Fellowships:

Jon Morse noted that fellowships were now named for Hubble, Chandra, Spitzer, Michelson and GLAST, with others contemplated. He suggested the Subcommittee consider whether additional fellowship names diluted their value; further, what criteria should determine creation of a named fellowship? Morse repeated his general wish to spend more on research and less on overhead. He proposed [slide #13] area fellowships, as follows:

Cosmic Origins: The Hubble Fellowship
Physics of the Cosmos: The Einstein Fellowship
Exo-Planets: TBD

Senior Fellowships:

Jon Morse urged the Subcommittee to consider, first, the awarding of senior fellowships and, second, whether integrated research could be funded through a single proposal. Regarding senior fellowships, Morse said he hoped to free the community's best talent to focus on research rather than proposal-writing. Kathryn Flanagan identified a research task: compare sets of Spitzer and Chandra data to determine what science was consistent with both. Morse agreed that multi-mission archives merited attention. Flanagan suggested that if 'good science' was the selection criteria, certain topics would go unaddressed. Fred Lo asked if research would be tied to missions; Morse said the tie would be to general science themes.

Slide #14-15: NASA Keck Time

Jon Morse reported that NASA was a 1/6th partner in the W. M. Keck Observatory, receiving 95 nights of telescope use annually; use was competed through proposal solicitation. Morse sought the Subcommittee's view on the pending renegotiation of NASA's cooperative agreement with Keck. Major points included: extend Keck use to all science categories; move administration of solicitations and allocations to headquarters; make a portion of NASA's Keck time available to NSF/NOAO beginning in 2009. Morse called some agreement aspects compelling; others required further consideration.

Slide #16: Astrophysics Division: Programmatic Balance

Jon Morse quoted two documents on the importance of programmatic balance: the Astronomy & Astrophysics Advisory Committee 2007 Annual Report, and the NRC 2007 NASA Astrophysics Program Assessment. Craig Hogan asked if the science advice of the National Academy was the 'Law of the Land.' Morse said it was; Congressional directives were the only exception.

Slide #17: Notional Astrophysics Program:

Jon Morse presented a chart showing the share of the Astrophysics budget going to each project, through FY'12. He noted that SIM, if added, would claim a large share of the profile. Morse said budget issues 'were controlling': the Beyond Einstein mission that could launch at lowest cost would be the mission launching first. Finally, Morse said Astrophysics could support only one flagship missions if it wished to maintain a balanced portfolio.

Slide #18: 2010 Astrophysics Decadal Survey:

The next decadal survey, Jon Morse said, would consider such questions as: What are the new science opportunities in astrophysics? What major initiatives might follow JWST? What are the future medium-class competed mission opportunities? What is the proper balance between projects in development, operating missions and R&A? He was seeking \$4 million to finance the survey, and intended to involve the community through town halls and other mechanisms.

Christopher McKee noted that Con-X was a flagship mission; LISA had expanded to flagship size: if the decadal survey chose one of these, would sufficient funds be available to the other? Jon Morse said if the community identified as its next major priority something that pushed all other initiatives into the future, that action would need to be considered from a portfolio standpoint. McKee asked if selecting Con-X might require shutting down something else: he noted that LISA entailed European cooperation: the Europeans might lose confidence and withdraw if NASA funding of LISA was too limited. Alan Stern commented that 'nothing bad' would happen to LISA in 2008. He regarded SIM as the potentially large problem: the expansion of SIM to a full-flight mission would cause havoc with the Astrophysics program; stretching out JWST would only partially alleviate this. Stern noted the 'very strong statement' of the American Astronomical Society [AAS] condemning the 'rogue' efforts whereby a Congressional earmark supporting SIM had been secured. Stern said he believed the Subcommittee's concern over SIM was well founded.

* * *

EXO-PLANET TASK FORCE

Heidi Hammel

Heidi Hammel reported [slide #4] that the Exo-planet Task Force was formed in December 2006, charged with creating a fifteen-year strategy to detect and characterize Exo-planets and planetary systems, and to identify nearby Earth-like planets and assess their habitability. Hammel noted [slides #5-9] the task force, chaired by Jonathan Lunine, met five times in 2007; that a rapid increase in papers in the field was occurring, and that 'a rich variety' of Exo-systems had been detected by various means. Hammel identified [slide #11] three central questions: What are the characteristics of Earth-mass/Earth-size planets in the habitable zone? What is the architecture of planetary systems? How do planets and planetary systems form?

Heidi Hammel presented [slide #12] the task force's Towards Earth recommendations: undertake intensive RV studies to reach down to Earth-mass planets around bright stars; and search for transiting terrestrial-size Exo-planets around nearby M dwarfs and characterize with Warm Spitzer and JWST. She described the capabilities of different missions relative to these tasks. Hammel presented [slide #16] additional Towards Earth recommendations: develop a space-

borne astrometric planet search mission; and prepare for a space-based direct imaging characterization mission. Hammel presented [slide #18] the Planetary Architectures/Formation recommendations, for microlensing for planetary masses and separations and for ground-based direct imaging. The latter step involved construction of a 30-meter telescope, with extreme AO; she noted task force discussion of the synergy of techniques could create an improved picture. Hammel presented [slide #22] additional Planetary Architectures/Formation recommendations, for circumstellar disk science, and for support for activities to maximize knowledge return and to train new scientists.

Heidi Hammel called attention to the need to define what fraction of stars had at least one potentially habitable planet. She identified [slide #25] three strategic goals, falling in five-year increments: first, to determine with accuracy the prevalence of candidate planets around various stellar types; second, to constrain the axes of planetary systems down to sub-earth for semi-major axes out of several AU; and finally, to characterize at least one Earth-sized planet for mass and basic atmospheric composition.

Heidi Hammel identified [slide #26] a two-pronged approach: use of fast-track ground-based and existing space assets to investigate M dwarfs; and, second, investment in new space-based technologies allowing investigation of F, G and K dwarfs. This, she believed, would take advantage of the early potential in investigating the Earth-sized planets of orbiting M dwarfs. More generally, the approach would address the key research questions, while providing opportunities for early discovery and risk reduction. Its execution would require a balance of ground- and space-based assets, both existing and future. She believed the plan would be responsive to surprises, failures and new discoveries; it was, she said, streamlined in cost, but could be stretched out.

Discussion:

Kathryn Flanagan asked how many habitable planets a given mission would likely identify; Heidi Hammel said this would vary, depending in part on the capabilities of the technique being employed. Michael Salamon asked if there was any basis for believing some types of dwarf stars would have more planets; Debra Fischer said no. She noted, however, that those M dwarfs studied thus far often had two or three rocky planets. Michael Cherry asked how more advanced ground-based capabilities could be created. Hammel responded that, in some cases, microlensing techniques could raise existing capability. Debra Fischer added that 'advanced' in ground-based viewing meant progress from three meters a second to one meter a second; another advance, she said, would be further development of infrared spectroscopy.

Christopher McKee praised the report; he noted that the TPF [Terrestrial Planet Finder] recommendations had urged that evidence of Earth-like planets be sought. McKee favored an astrometric mission: he asked to what extent SIM could meet its requirements. Hammel said assessment of particular mission capabilities fell outside the charge to the task force. Tom Greene said the assessment presented of JWST's possible contribution appeared optimistic; Hammel said the task force had worked from specific white papers presented to it. Fred Lo noted that while three science goals had been identified, the recommendations focused on the first two. Hammel acknowledged this; the questions, she said, were prioritized: most emphasis fell on the first; some on the second; the third would be clarified as the first two were addressed.

Fred Lo said 'habitable zone' had sparked public interest; that interest aside, how had the task force prioritized? Heidi Hammel said the specific charge given the task force had been to seek Earth-like planets in the habitable zone. Debra Fischer said this charge was the important driver for the effort; Hammel said, of the importance of the effort, that questions which humanity had asked for centuries were now within reach of being answered. Andrew Lange noted the potential role of SIM; he asked by what margin could SIM satisfy program requirements? Fischer noted that SIM had a considerable list of scheduled activities beyond Exo-planets; if this entire menu was to be completed, SIM would lack sufficient time to study 100 planets.

Andrew Lange asked if the task force was proposing a 'way forward' for undertaking needed studies. Hammel characterized this as a difficult problem; the task force had no specific recommendation. Debra Fischer said the task force was oriented to establishing the thriftiest, highest yield path. Craig Hogan asked if the task force's work would serve as foundation material to help frame priorities in the 2010 Decadal Survey. Jon Morse said that following mid-February endorsement by the AAAC [American Association for the Advancement of Science] the task force report would be sent to the funding agencies. Craig Hogan asked in the main branch points and contingencies were identified: Morse said they were. He added that attention was also being paid to the technology requirements and the need to choose a judicious technology course that moved things along. Kathryn Flanagan noted that while the task force report identified two major missions, it did not assume both would launch: indeed, she thought two major missions in fifteen years unrealistic.

Heidi Hammel commented that the report was informational; the task force was not seeking feedback on its content. She noted the full report would be available following its presentation to AAAC.

* * *

KECK TIME USAGE DISCUSSION

Zlatan Tsvetanov
NASA Program Scientist

Zlatan Tsvetanov noted NASA had participated in Keck since 1996 and had paid one-sixth of Keck's [telescope number two] construction and operating costs: in exchange, NASA received 95 viewing nights on each telescope. Tsvetanov estimated cumulative NASA Keck expenditures at \$70 million, about evenly divided between construction and operations, which currently cost about \$3 million annually. Tsvetanov noted that current NASA work at Keck touched on two goals in the SMD Science Plan for Astrophysics, 2007-2016. Zlatan Tsvetanov outlined the current proposal on NASA's Keck use.

First, review the cooperative use agreement with Keck

Second, open Keck use to all Astrophysics categories

Third, administer proposal solicitation and allocation of Keck time through NASA headquarters

Fourth, agree to make half of NASA's Keck time available to NSF/NOAO [National Science Foundation/National Optical Astronomy Observatory] in exchange for NASA access to all facilities available to NOAO.

Discussion:

Jon Morse said Astrophysics could reclaim Keck time from NOAO for strategic purposes; e.g. activities targeted toward particular mission support. Thomas Greene asked if separate TAC panels would exist for strategic and non-strategic use; Morse said yes. Greene said NASA's Keck time had in recent years been oversubscribed by a three or five-to-one ratio; extending Keck access throughout astrophysics might worsen that. Zlatan Tsvetanov said oversubscription had been less than that.

Jon Morse said coordination with NOAO would follow existing rules and procedures for large projects. Thomas Greene said NASA community members were already eligible to propose uses for observatory time at facilities available to NOAO; Morse said the agencies would 'be integrating the pots of time.' Zlatan Tsvetanov said major projects would receive targeted time use; he considered this a preferable means of securing needed answers. Morse described Keck as a valuable strategic asset: while he believed NASA's agreement should be maintained, he doubted agency participation needed to be increased. Neil Cornish said NASA's original Keck involvement had a focused reason; if that focus was to be lost, then the arrangement with Keck made less sense.

Jon Morse said he regarded the utility of Interferometry to Exo-planets as fairly mature; this proposal was forward looking: in the future, more emphasis would be placed on expanding NASA's science capability than on expanding technical capability. He believed the proposed arrangement would leverage the value of future activities.

Debra Fischer said Keck had offered enormous advantages: this proposal might be an attempt to fix something that wasn't broken; she thought NASA would gain little from entering the [NOAO] system. Heidi Hammel seconded Fischer's comments: Keck was unique for NASA science; in particular, for single dish work. Hammel was concerned the proposal might degrade the science coming from Keck; currently, NASA was not receiving a great deal of time; this would decrease it further. Jon Morse cited the argument that NASA would get better science by buying into the system. Belinda Wilkes opposed surrendering any Keck time; she thought all was required. Hammel said she had no objection with points one and two, above.

* * *

SCIENCE MISSION DIRECTORATE UPDATE

Alan Stern
Associate Administrator
Science Mission Directorate

Slide #2: SMD's Science Program Leads the World:

Alan Stern reviewed the scope of SMD activities, including \$5.5 billion in annual expenditures; 94 flight missions; 3000 grants in any given year. He noted that SMD's activities exceeded those of the rest of the world combined.

Slide #4: Strong Community Concerns:

Alan Stern identified as community concerns: resource constraints; declining launch rate; reduction in R&A funds; slow progress on 2000 decadal survey objectives, and the view that SMD was insufficiently responsive to these issues. He noted that funding was the responsibility of Congress; he believed progress was occurring on other points.

Slide #5: SMD's New Team:

Alan Stern noted that SMD included many new faces; he noted creation of the post of Senior Advisor for R&A [SARA]. He said NASA staff worked very hard, under considerable and varying pressures from Congress, the media and others.

Slide #6: Meeting the Issues:

Alan Stern said cost control was a precondition to increased flight rates. He believed JWST made the Astrophysics division budget top-heavy. He advocated expanded foreign collaborations, both in Asia and Europe. He believed R&A was more than a budget issue: better processes would permit more science with less paperwork. Missions should be reviewed to determine if each was meeting its highest science priorities: e.g., one HST goal was to determine the Hubble Constant within 15 percent; this had been achieved: what about other initial Hubble goals?

Slide #7: Actions Taken Since April 2007:

Since April 2007, Alan Stern said, \$150 million in cost overruns had been avoided; four new SMEX missions had been authorized [replacing one MIDEX]; flight rates for suborbital rocket and balloons had increased; R&A had been protected against any further budget cuts. Further, Stern intended to simplify AO processes; these, he believed, had accreted complications over time. Asked about R&A funding, Stern commented that the FY'08 action to prevent further cuts had been a defensive move; the offensive moves would come in FY'09.

Slide #9: More Flight Program Changes Are Afoot:

Stern noted that \$70 million was available for a Mission of Opportunity; down-selection would occur in May-June 2008; Missions of Opportunity would become annual. SMD desired an Exo-planets program that kept the Astrophysics portfolio healthy; while no other flagship mission would proceed simultaneous to JWST, it remained important that progress be made.

Slide #10: R&A Changes Have Been Made:

Alan Stern praised the work of Yvonne Pendleton, Senior Advisory for R&A, in 'clearing the underbrush' – many grants had been extended to four years; notification times to grant recipients had been considerably reduced.

Slide #13: The Road Ahead

Alan Stern characterized the future: more science would be achieved relative to funding; U.S. scientific leadership would be promoted across all SMD disciplines, and the American public would gain a better understanding of the range, relevance and impact of NASA activities. Stern said he regarded NASA activities as an aspect of U.S. foreign policy.

Slide #15-17: Launch Rates:

Alan Stern attributed declining launch rates to repeated cost overruns. He noted that after Michael Griffin was appointed NASA Administrator, Griffin had 'owned up' to \$4 billion in hidden costs and deficits; total cost overruns since FY'03 were estimated at \$5.8 billion. If maintaining cost discipline required the cancellation of a mission, this would be done; the budget realism of proposed projects would be central to their approval. The effect of cost overruns, he said, was to 'slaughter the innocent' – that is, reduce support for future missions that had not presented any financial problems.

Christopher McKee asked how better estimates could be secured; he believed a project must be 10 percent complete before its costs were reasonably knowable.

Alan Stern advocated creating budgets with higher reserves; having more experienced PIs; and not 'pushing' more than one new technology on the same mission. Stern noted that the flow of resources to JWST had also impacted launch rates. Stern said community support was needed to achieve the better cost control that would permit a balanced program and progress on decadal survey objectives.

Slide #18: Decadal Survey 2010:

Alan Stern identified three priorities for the 2010 Decadal Survey: creation of a baseline plan that fit a baseline budget; use of independent cost estimates in prioritizing missions, and creation of mission 'tripwires' to cancel missions if a given cost overrun was reached.

Discussion:

Lucy Fortson asked if proposal writers were becoming more cost conscious; Alan Stern said he did not know. Fortson asked Stern's source for the objectives identified for the 2010 Decadal Survey. Stern said they had 'sprung forth' from SMD. Fortson asked if existing data supported the preference for more experienced PIs. Stern said it was 'impossible to defend' giving a \$1 billion budget to someone with no space flight experience.

Eric Smith noted that large Astrophysics missions characteristically ended with costs two to five times their original estimates. Stern observed that large missions found it easier to go over budget; so much was invested in them that it was harder to call a halt. Michael Cherry said programs were difficult to cancel: were others 'on board' with this possibility? Stern said the Space Studies Board was. Stern noted community reluctance to cancel a mission, in part, he said, because it sympathized more with the 'explicit' victim – that is, the mission with the overrun -- than the implicit mission – that is, missions that might be deferred or cancelled because of that overrun. The broad question was how to optimize the full Astrophysics program.

Neil Cornish said tripwires had been discussed previously; he believed they tended to backfire: how would they work in practice. Alan Stern commented that had a \$2 billion tripwire been imposed on JWST at the start, that project would not be presenting the magnitude of financial problems it was. Andrew Lange suggested tripwires would encourage a more conservative approach to missions. Debra Fischer supported tripwires, but asked what would happen if cost increases stemmed from factors outside mission control. Stern said that increased costs, whatever their cause, made it legitimate to consider if a project remained worth pursuing.

On the 2010 Decadal Survey, Christopher McKee noted consensus that no one should be disenfranchised; he reported efforts being made to secure DoE [Department of Energy] participation. Heidi Hammel said that two years ago, when the Subcommittee had been formed, there was considerable 'sturm und drang' about the future, particularly on how the lunar initiative might facilitate astrophysics: now, it appeared the division was back 'in its own sandbox.' She asked if, in consequence, there were important considerations of which the division was unaware. Alan Stern acknowledged the wisdom of 'avoiding a war on one's flanks': he noted a program to see how the Aries and other architectures could be used in 2020s; he noted work by Matt Mountain, Director, Space Telescope Science Institute, on lunar proposals. In sum, Stern believed 'a lot of little things were springing up.'

* * *

BEYOND EINSTEIN

Charles Kennel [via speakerphone]
Chair, Beyond Einstein Program Advisory Committee
[BEPAC]

Charles Kennel presented [slide #2] the charge to his committee: first, determine which Beyond Einstein mission should go first; and, second, provide for each candidate mission an assessment that would be of future value. Kennel thought it important that the Subcommittee understand the workings of BEPAC, which, he said, employed techniques that might be useful to the 2010 Decadal Survey. Kennel noted that the mission selected from the eleven candidate missions would be matched with the Astrophysics funding wedge that appeared in FY'09. He drew a distinction between the questions 'which goes first?' and 'which is best?' BEPAC's central criterion was scientific value and readiness; at the same time, BEPAC gave attention to how the readiness of the ten missions not selected could be furthered. Kennel said the charge to the committee had been 'exceptionally well constructed.'

Executing its charge, Kennel said, required BEPAC to convene multidisciplinary panels of physicists, astronomers and those experienced in spacecraft engineering [slide #3: committee membership]. Kennel noted that this collaboration crossed 'cultural differences' and likely would have failed had the group not had a clearly outlined task. In practice, he said, the panel's mixed nature modified discussions in way that proved very fruitful. Kennel said a panel was created for each candidate mission; each was directed to become expert on its mission, and bring evaluation and conclusions to the group. Science evaluation was based on the science goals developed by the Beyond Einstein program [slide #4].

Charles Kennel identified [slide #13] the science criteria for evaluating each candidate mission: advancement of Beyond Einstein research goals; broader science contributions; potential for revolutionary discovery; science risks and readiness, and the mission's uniqueness in addressing its scientific questions. Craig Hogan asked if timeliness had been a criterion: a question of greatest interest now, he observed, might be of less interest by time its associated mission actually flew. Kennel said this was a consideration; he noted, however, that as a 2009 start date suggested a 2015 flight date, the timeliness question was to a degree answerable. Kennel outlined [slide #15] the procedures for assessing mission cost and readiness; costs were determined in part through historical analogies and standard models for assessing complexity.

Charles Kennel presented the BEPAC findings, as follows:

Finding #1 [slide #18] -- 'Beyond Einstein science issues are so compelling that research in this area will be pursued for many years to come...' Kennel noted that while Congressional committees had been uncertain whether Beyond Einstein was a scientific field or a one-off mission, he thought the questions so basic that scientific community would return to them often.

Finding #2 [slide #19] -- 'The Con-X mission will make the broadest and most diverse contributions to astronomy.'

Finding #3 -- LISA [Laser Interferometer Space Antenna] and JDEM [Joint Dark Energy Mission] were identified as two areas that 'stand out for the directness with which they address Beyond Einstein goals.'

Finding #4 [slide #20] -- While BEPAC termed LISA 'an extraordinarily original and technically bold mission concept,' the committee thought LISA it be 'the flagship mission of a long-term program addressing Beyond Einstein goals.'

Finding #5 [slide #21] – BEPAC believed that certain technologies required by LISA Pathfinder were unready; therefore, it advised giving LISA a new start once LISA Pathfinder findings were available.

Finding #6 [slide #22]: JDEM, BEPAC found, will 'set the standard in the precision of its determination of the distribution of dark energy in the distant universe.' Additionally, Kennel said, JDEM would provide highly detailed information for understanding how galaxies form and acquire their mass.

Finding #7 [slide #23]: BEPAC believed JDEM had the highest probability of proceeding to launch.

Charles Kennel said BEPAC had concluded that what NASA was presenting as \$600 million probes would actually be \$1 billion undertakings. He said the Beyond Einstein funding wedge appeared inadequate for all candidate missions reviewed.

BEPAC, Charles Kennel reported, was recommending that NASA and the Department of Energy immediately organize a competition to select a JDEM mission for a 2009 new start. That mission should seek to determine the properties of dark energy with high precision. BEPAC urged that a wide variety of mission concepts and partnerships be encouraged.

Discussion:

Christopher McKee noted that BEPAC regarded Con-X as partly within Beyond Einstein; partly outside it: McKee believed NASA had placed Con-X within Beyond Einstein for budget reasons. McKee suggested that any mission not placed in a set 'home' was at a disadvantage. Charles Kennel said BEPAC's view was that placing Con-X in Beyond Einstein underestimated its breadth; further, the committee doubted this was to Con-X's advantage: Kennel thought Con-X potentially had the broadest impact of any candidate. Jon Morse suggested the question of the budget category assigned to Con-X was a distraction; no category other than Beyond Einstein existed to place it in. Kennel noted the 2000 Decadal Survey had ranked Con-X as second; he believed the 2010 survey might rank it similarly high. McKee asked, if the community was told it had \$600 million to spend, would JDEM be its top priority? Kennel said BEPAC had not considered how JDEM would fare under de-scoping; the charge had been to assess the mission readiness. De-scoping had been an issue only with Black Hole Finder, which BEPAC regarded as much larger undertaking than originally thought.

Neil Cornish called attention to BEPAC's second charge: assess candidate missions in ways of value in the future. Charles Kennel said this was highly important: while most people were chiefly interested in 'who wins the horse race,' BEPAC had been at pains to explain its process so all would know what 'winning' meant.

Brenda Dingus noted that three different ideas for JDEM had been advanced; how had BEPAC determined their respective costs and readiness? Kennel said two proposals had been well documented; he characterized the technologies involved as fairly well in hand and he thought any of the candidate missions would do the job. Brian Dewhurst [NRC, by speakerphone] said the third candidate mission had had documentation, but declined to present it for proprietary reasons. He noted that BEPAC, unlike a decadal survey, was a competitive environment; therefore, there was hesitancy about sharing information. Jon Morse identified a circumstance to which the Subcommittee might have to respond: a project advocate stated that something could be done, but declined on proprietary grounds to say how.

Michael Cherry noted that AMS [Alpha Magnetic Spectrometer] had been mentioned; he was unaware that Congress had entered into its discussion. Charles

Kennel said NASA Administrator Michael Griffin, in a January 2008 speech, had said he was 'at a loss' to see how the NASA budget could accommodate AMS. Jon Morse said AMS had been devised in the 1990s, with the expectation that it would be flown to the International Space Station [ISS]. When the Space Shuttle manifest was reassessed following the Columbia accident, shuttle use was dedicated to those things needed to maintain the long-term viability of ISS. Currently, no shuttle time existed to accommodate AMS; further, no funding source for the project had been identified. Morse described his statement as a 'warning flag.' Re-configuring AMS and flying it to ISS would involve substantial funds, he said; further, the question of sequencing AMS within Beyond Einstein was unresolved. Morse said conversations with the National Academy on this subject were in progress; he thought AMS represented a 'multi-hundred million dollar threat' to the Astrophysics portfolio.

Charles Kennel said the BEPAC experience brought home the importance of establishing early clarity as to task; he commended those engaged with BEPAC, saying review teams had done 'a heroic amount' of work.

* * *

ASTROPHYSICS DIVISION: R&A STATUS

Wilton Sanders

Wilton Sanders identified [slides #2-3] the elements and budgets of Astrophysics R&A: Supporting Research and Technology [\$50 million]; Data Analysis [\$88 million]; Mission Science teams [\$75 million]. Some disbursements, he said, would support a researcher and assistant; others were quite small: over-subscription ranged from three to six. Jon Morse commented that, with technologies, a given detector might be used at different wavebands; that is, technology could be cross-cutting physically. Morse noted that Physics of the Cosmos employed technology developed 'through the entire pie.' Craig Hogan asked if the 'pies' followed from how committees were organized; Morse replied it was largely traditional. Sanders presented [slides #4-5] data on data analysis budgets by budget share and program.

Sanders presented [slide #13] 2006 Statistics for ROSES [Research Opportunities in Space and Earth Sciences]; he noted the success rates for university v. NASA researcher were similar; and [slide #16] the 2007 ROSES review schedule. Sanders said, generally, proposals were graded by an absolute standard; then, selections were made by a 'giant free-for-all.' This, he said, reflected an intelligent assessment of proposals and how each matched with programmatic applications. Sanders noted [slide #17] 2008 changes in ROSES: new wording permitting four-year funding; encouragement of suborbital proposals, and inclusion of technology and training as factors of intrinsic merit. Sanders described [slides #18-19] budgets over time, saying that changes in budget categories made comparison difficult. Sanders presented [slide #20] information on review panels: sub-millimeters went to the same panels, as has been done in x-ray and gamma-ray. He would wish to pursue this approach.

Wilton Sanders presented [slide #21] Issues and Concerns, including:

Devastating funding cuts in recent years

The absence of APWG [Astronomy And Physics Working Group] or UWG [Universe Working Group]

Absence of a structured process for detached assessment of funding balance across disciplines; theory; data analysis; fellowships, etc

Absence of clarity on impact of proposal pressure, i.e. of demand-based balancing

Discussion:

Sanders questioned whether this Subcommittee was the appropriate body to review these issues. He characterized the view that more time should be spent on science; less time on writing applications as a 'winners' perspective – that is, a view of grant recipients who wished to reduce their paperwork requirements. He reported that funding for theory work remained at 20 percent of the total; he believed those doing theory work could generate many more proposals if funding was available. Craig Hogan suggested that maintaining a 'quality balance' in R&A allocations across activities might require a Senior Review. Sanders said rough shares had not changed in a decade; perhaps the assumptions behind this should be reconsidered. Michael Cherry noted that Senior Review of R&A had been discussed for some time: was discussion becoming more serious? Sanders endorsed a Senior Review, but added that given the heavy review schedule set for 2008; such review might be postponed until 2009. Sanders suggested that, while an under-funded research effort could 'limp along' for a time, if under-funding lasted for eight years, a particular scientific community might be lost. Fred Lo said some level of funds was required to preserve a scientific community; Andrew Lange characterized such efforts as preserving the 'seed corn' of future missions. Eric Smith rejected the suggestion that this issue was not receiving sustained attention; the problem, he said, was that giving funds to anything required funds be taken from something else.

Discussion turned to the question: must technology development be mission-driven? Brenda Dingus said people did not present proposals on infrared detectors simply because they liked infrared, but because these were important to future missions. Eric Smith noted that some panels took a longer-term view than others; these were more inclined to fund efforts for the future. Wilton Sanders said reviews did not fund the 'top X percent,' but made decisions related to need. Jon Morse noted an interaction between science push and technology pull; he anticipated this would continue. Sanders said that proposal backers, not panels, bore responsibility for establishing need. Morse expressed concern that efforts were piecemeal; NASA, he said, would benefit by establishing sustained centers of excellence of sufficient size to do challenging things.

Fred Lo stressed the importance of continuity in expertise and infrastructure. Morse said the concern that a capability would be lost was often expressed; however, NASA did not bring private industry a business volume sufficient to ensure capabilities would be maintained. Christopher McKee expressed agreement with the comments of Lange and Lo: he termed the issue challenging, adding that when long-term groups had been maintained in the past, peer review had been inadequate and quality tended to decline. Michael Cherry noted that several years ago, Congress and NASA upper management, wishing emphasis placed on missions, had been unsympathetic to the 'seed corn' argument: he very much welcomed that this was changing. Morse commented that theory work was as mission-enabling as any other; he believed this view had been effectively conveyed to Congress. Morse added that when budgets were tight, small investments in theory work could yield substantial results. Cherry endorsed this statement. Belinda Wilkes noted the Yvonne Pendleton, SARA, had sought the Subcommittee's informal advice. Jon Morse asked whether a working group or some other mechanism would address this need; if the former, such a group could be established. He said R&A would be the next matter addressed following the 2008 Senior Review.

Jon Morse raised an additional issue: Exo-planet missions had been removed from the Discovery program; the reason, he said, was that such missions were more ambitious than Discovery could accommodate. He believed there was no shortage of

Exo-planet medium-sized mission concepts; the mission concept phase would begin imminently. Neil Cornish asked if this implied a net reduction in Discovery program funding. Morse noted that when Kepler was moved to Astrophysics, the program budget traveled with it; there would, however, be no donation from Discovery to Astrophysics. His intention was to 'break out' Exo-planets, then grow it; in general, he preferred to do what was possible now than to delay in hopes that funding would increase.

Heidi Hammel said that on the planetary side, mission lines had succeeded in part because they were open to all fields; she termed Explorer an example. Now, Hammel added, it appeared New Frontiers would be grown as a separate thing. Morse said the understanding was that JDEM would be the first in a series of medium-class ventures; he noted that un-prioritized funds tended to disappear from the budget. Kathryn Flanagan noted that the Einstein probes had been defined by a set of questions; was Morse's intention similar now? Morse said it was not clear a sequence could be defined. Christopher McKee said decadal surveys had never prioritized Discovery missions, and these occurred over too short a time span. McKee added he was aware of reasons for science categorizations that related not to the science, but to programmatic considerations such as need for cost contingencies.

The Monday, January 28, 2008 session adjourned at 5:30 p.m.

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Session of Tuesday, January 29:

Craig Hogan, chair, convened the meeting at 8:30 a.m. He called attention to the task of drafting of the Subcommittee's letter, which, he noted, needed to reach the NASA Advisory Committee [NAC] by Monday, February 4.

SMD R&A ISSUES AND E/PO

[Education/Public Outreach]

Yvonne Pendleton

Senior Advisory for Research & Analysis [SARA]

Yvonne Pendleton identified [slide #2] members of the SARA Team, and outlined [slide #3] the group's commitment: increasing R&A budgets; obtaining a larger science result from any given budget through process improvements; supporting data analysis and ensuring that missions funded their science, and providing responsive science leadership. Pendleton identified [slide #4] changes already made, including protection of existing R&A budgets and the decision to stop redacting budgets from review panels. Pendleton noted that when NASA adopted full cost accounting procedures, the costs civil service scientists were required to report nearly tripled. The action on redacting, she said, was to 'level of the playing field,' so that the emphasis would be placed on the work being done rather than the cost. Fred Lo asked if the major issue had been the disparity in costs presented by NASA v. university researchers. Pendleton said that had been the case; the discussion of cost effectiveness still had to happen within all panel reviews.

Yvonne Pendleton noted four-year grants had been widely authorized; all review panels would be made aware of this. While she believed longer term grants would promote stability for researchers, she noted that program officers held final

authority. Kathryn Flanagan said that in some categories, three-year grants might remain the most appropriate; longer-term awards might reduce year-to-year flexibility. Craig Hogan noted that four-year grants were better matched to standard doctoral undertaking; he reported receiving considerable favorable comment on this step. Yvonne Pendleton described efforts to speed notification to researchers of grant awards. She said further improvements were necessary; the standard notification times varied considerably across the scientific disciplines.

Yvonne Pendleton reported complaints from program officers on difficulties in filling their panels. She suggested Post-Doctoral researchers might be tapped for membership; when she floated this idea to the community, a dozen Post-Docs had expressed interest. She believed this group contained 'some gems'; however, filling panels remained the prerogative of the program officer.

Yvonne Pendleton reported on [slide #5] efforts to define, document and distribute best practice information on program reviews. Thomas Greene welcomed this step, which he said would greatly benefit visiting program officers.

Yvonne Pendleton noted that she had been charged by Alan Stern with re-invigorating E/PO; in consequence, she was 'building bridges' to the Office of Education, the National Science Foundation and others.

On related matters, Pendleton said she believed \$15,000 grants required too much effort and overhead for the science produced, and, that support systems for research students needed to be clarified: funds were currently spread around the agency, making it difficult to judge the overall effort. Pendleton said she favored creation of larger funding opportunities; this reflected the view that researchers might work productivity in ways other than as individual PIs. Christopher McKee noted that group grants had existed in the early astrophysics theory group; in practice, however, he said panels preferred giving grants to multiple individuals than to a group. He believed problems were inherent when individuals and groups competed for the same money. Fred Lo said it was difficult to measure individual v. group productivity. McKee responded that all could make their cases when applying for renewal. Lo asked what the duration of institutes – e.g. the Lunar Science Institute – had been; Pendleton said such groups had operated for five years.

Yvonne Pendleton introduced [slide #6] the membership of the Management Operations Working Group [MOWG], an advisory body which would first meet on February 11, 2008. She noted that as this was not a FACA committee, it could not give advice as a body, only as individuals. Pendleton reported that SARA had received consideration communications, including 1300 emails at sara@nasa.gov.

Yvonne Pendleton identified [slide #14] current E/PO challenges. First, she believed outreach opportunities were unnecessarily burdensome. Second, she believed current education activities were too broad to be financially secure. Third, she believed a general review of NASA E/PO was merited. Pendleton reported that NASA E/PO personnel were increasingly professional; she cited Astrophysics as the leading example of this. Pendleton suggested that infrastructure shifts might be needed to accommodate this expertise. Pendleton presented [slide #15] the charter and membership of the E/PO MOWG, and praised energy of its chair, Emily CoBabe-Ammann, University of Colorado. Pendleton presented [slides #17-18] budget summaries: these showed \$30 million for mission E/PO; \$20 million for non-mission EPO, with the full amount about equally divided between education and public outreach.

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ASTROPHYSICS DIVISION E/PO
Hashima Hasan
Astrophysics Division E/PO Lead

Hashima Hasan provided an overview of Astrophysics E/PO activities [slide #2], including embedded Astrophysics activities; the Astrophysics component in SMD and Office of Education activities; activities related to the pending International Year of Astronomy [IYA] and those related to the Hubble servicing mission [SM4.]

Hasan identified a goal of having a 'steady state' of twelve NASA Earth and Space Science Fellows. Craig Hogan noted the multiplicity of graduate student programs; what special niche did the NASA Fellowships serve? Hasan acknowledged that the program was small, but said it intended to attract to NASA 'the best of the best.' Hogan asked if the program was succeeding. Hasan said participants were not tracked; however, considerable anecdotal evidence suggested many fellows entered NASA; applications were of a very high quality. Fred Lo asked about program oversubscription; Yvonne Pendleton said seven individuals had been chosen from 57 applicants.

Andrew Lange welcomed this year's increase in program size. Eric Smith said the program had for many years maintained a steady state of twenty participants; then, funding was reduced. Lange noted that, at one time, some fellowships were attached to centers or to headquarters. Hasan responded that centers continued their GRSP [Graduate Student Researchers Program]; however, information on them was obtainable only on individual websites. Lange asked if NASA generally attracted 'the best of the best,' what purpose did this program serve. He believed added value would come if fellows worked closely with a particular NASA center; these, he thought, were having difficulty obtaining graduate students. Pendleton welcomed the suggestion. Lange believed individual centers risked becoming isolated; adding graduate students to centers would encourage academics to develop better partnerships with NASA. Pendleton said she had asked the MOWG to take a look at this; she termed the interest in the room very heartwarming.

Yvonne Pendleton noted that some activities had been moved into R&A in the belief that, if located there, funding would be more secure. Neil Cornish asked if it would be procedurally appropriate to have a MOWG representative make a presentation to the Subcommittee; Eric Smith said it would. Kathryn Flanagan noted the Subcommittee had once had a subordinate group to provide advice on specific issues; E/PO might be such a topic. Yvonne Pendleton said her understanding was that this could not be done. Neil Cornish suggested that coordination would improve if several Subcommittee members sat on the MOWG. Heidi Hammel noted that the Subcommittee generally had several members with strong backgrounds in E/PO; Smith said several current Subcommittee nominees had such background.

International Year of Astronomy:

Hashima Hasan described [slides #4] the International Year of Astronomy [IYA]: 2009 marked the 400th anniversary of Galileo's use of the telescope. IYA, Hasan said, was an E/PO priority. Hasan identified [slide #5] the U.S. goal for IYA: 'To offer an engaging astronomy experience to every person in the country, nurture existing partnerships and build new connections to sustain public interest.' She outlined [slide #6] major themes for US participation; NASA's involvement [slide #7], and desired outcomes [slide #8]. She identified a web portal, www.Astronomy2009.nasa.gov, currently under construction, for information on IYA. Hasan identified [slide #10] NASA highlights during IYA: the new Hubble capabilities;

SOFIA's first science flight, and launches of Kepler, WISE, Mars Science Laboratory and Solar Dynamics Observatory. Robert Clayton called attention to Stardust Mission; this would involve thousands in what he thought would be a great success.

EPO – Hubble SM4:

Hashima Hasan [slide #16] noted the HST servicing mission [SM4] would be highly visible; it was receiving major attention throughout NASA: the U.S. Department of Education was actively involved. NASA E/PO would present HST as a 'people's tool' – today's greatest explorer, whose servicing will ensure frontier science through 2013. Hasan [slides #17-18] outlined related activities directed at audiences ranging from K-12 to scientific professionals and culminating with the release of an IMAX film through the Department of Education. Other ideas [slide #19] were 'Hubble Week' in schools, museums and elsewhere; a 'Nickelodeon' show; a 'Hubble Day' contest for schools, with the winners meeting the SM4 astronauts; and others. Hasan said activities to sustain public interest in the event SM4 was delayed were under consideration.

Hashima Hasan invited suggestions. Lucy Fortson urged creation of a 'Hubble Pallooza' traveling team, similar to the earlier 'Mars Pallooza.' Kathryn Flanagan said quick action was needed on events involving schools, as they would close for the summer. Thomas Greene suggested that contest-winning students meet with Hubble scientist as well as astronauts; Hasan endorsed the suggestion. Heidi Hummel suggested student involvement could be promoted through My Space and You Tube. Craig Hogan asked if students could be solicited for ideas directly; Hasan responded that time was short. Doris Daou of E/PO described the forthcoming IYA website: it would be content oriented and explain how people could get involved at the local level; the site will be operative by summer 2008.

General E/PO Discussion:

Hashima Hasan called attention to 'Touch the Invisible Sky,' a book by Noreen Grice and others that combined tactile NASA images and Braille to introduce the heavens to the blind; the book's design permitted a sighted mother to read along with a blind child. Hasan terms this a very effective use of NASA E/PO funds. Heidi Hammel reported she was working with Noreen Grice to develop 'Touch the Solar System,' which would use different texture to indicate content. Kathryn Flanagan urged involving students by providing archival data from Chandra; Great Observatories data could similarly be made available. Flanagan commented that NASA was often not credited as a source; for example, in 'Google Sky.'

Craig Hogan asked how the impact of E/PO activities could be measured. Yvonne Pendleton said she as yet had no answer to that. Thomas Greene raised a similar query. Pendleton said one could track individual student activity, but measuring impact on the general public was difficult. Hasan noted that all E/PO programs were required to have an evaluation plan. Lucy Fortson noted that evaluation methods used in education were generally expensive; the cut in E/PO mission funds had reduced funds available for evaluation. She believed mission-specific E/PO was done fairly well; she knew no practical way to gauge the impact of specific activities on the public.

Yvonne Pendleton said too few PIs were engaged in the E/PO effort. Lucy Fortson reported that many in the E/PO community believed non-mission specific E/PO funds would be distributed to PIs NASA-wide; this, she said, had prompted

considerable anxiety. Pendleton said she was '99 percent sure' this would not occur; however, she thought some initiative to deepen PI engagement with E/PO was likely. Fortson asked how PI involvement could be increased without upsetting overall E/PO strategy; she would welcome a recommendation from the Subcommittee on this. Kathryn Flanagan noted that she worked in a university; had never rejected an E/PO request; and currently one-third of the people there were engaged in E/PO work. Flanagan said encouraging this involvement was 'the right thing to do.' She said the common difficulty with E/PO projects was that the funds received frequently met only half the costs; in consequence, matching funds must be secured.

Heidi Hammel said that the past practice of devoting a percentage of each mission's costs to E/PO had underscored the Astrophysics community's view that E/PO was important to its mission. Hashima Hasan noted the upper limit on what a mission could devote to E/PO had recently been raised to one percent of project costs; further, expenses related to student collaboration did not count against this limit.

Christopher McKee said he was surprised that no firm way existed for evaluating general E/PO activities; he believed some understanding existed for evaluating mission-related E/PO. McKee said the funds NASA spent on education were 'a drop in the bucket': still, all would wish it to be an effective drop. Yvonne Pendleton said schools used mission-related E/PO products with what appeared to be impressive frequency; however, she had doubts about the data: what was meant when a classroom teacher reported using a product? McKee said it appeared the effect was unknown. Lucy Fortson said studies to determine effects concretely would absorb the entire E/PO budget. McKee asked if, in effect, 'no one had a clue'? Pendleton said it was impossible to evaluate \$15,000 grant cost effectively. McKee acknowledged that, given the range of influences in a child's life, assessing the impact of one finite effort would be difficult. Fortson referenced the recent National Research Council report on evaluation; she asked if this report would inform Pendleton's efforts. Pendleton was the report was still being digested. Pendleton noted, as a further point, that resolution was needed on whether NASA or Department of Education was the appropriate agency for particular undertakings.

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Craig Hogan previewed Subcommittee letter writing by presenting a list of 'above the line' topics its letter was likely to address. These included:

- Keck renewal
- Consolidation of the prestigious post-docs
- Senior fellowship proposal
- SIM: the science community and earmarks
- AMS: comment on the review plan
- Reorganization of the Astrophysics Division
- Reforms – streamlining, etc.

Discussion was tabled.

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SCIENCE PLANNING DISCUSSION UPDATE

Eric Smith
Executive Secretary
NAC Astrophysics Subcommittee

Eric Smith reported that Alan Stern wished to have the 2009 Science Plan mesh with the 2009 President's budget release. Stern had requested the Office of the Chief Scientist [John Mather; Andrew Cheng, Randy Friedl] to recast the 2007 Science Plan as the 2009 Science Plan: both documents (budget and plan) will be released in early February. The Subcommittee, Smith said, should regard the 2009 Science Plan revision as complete; he believed common release dates for the science and budget plans was reasonable. Smith said the 2009 Science Plan for Astrophysics would be very similar to the 2007 plan: NuSTAR and revised language on planet finding would be added; the science questions and the science story remained the same. Smith noted that this coordinated release was occurring across SMD. Kathryn Flanagan sought affirmation that the 2009 Science Plan would not be presented as a community document; Smith agreed this was the case. Belinda Wilkes said in the past it had been a problem that the science plan and budget were out of phase. This, Smith described as an inherent flaw in the system which Stern was addressing; he added that Stern wished the document to be less 'tome-like' and more a decision rule-based document.

Kathryn Flanagan noted, first, Jon Morse's comment that Con-X 'lived within Beyond Einstein'; second, BEPAC's position that Con-X did not fit within Beyond Einstein, and, third, the circumstance that Beyond Einstein might be terminated. She characterized Con-X as a widely supported mission that lacked a ready location. One alternative, she said, was to place it within Physics of the Cosmos. Christopher McKee said he did not regard Con-X as intrinsically a budget issue; the problem, he said, was that the mission had been placed in an impossible position. In general, he said, organization should serve science goals, not the reverse.

Eric Smith took the occasion to thank those Subcommittee members attending their final meeting. He noted that when the Subcommittee had been re-started, members received either two- or three-year terms to structure rotating membership; this accounted for the large number now departing. He praised outgoing members for their willingness to 'stick with things' during a difficult time; he hoped they knew how greatly NASA scientists appreciated their input.

Jack Burns [by speakerphone] noted that he would attend his first NAC Science Meeting the following week; he urged Subcommittee members to communicate to him any concerns they wished taken to that body. Specifically, he sought comments on Keck and SIM. Craig Hogan said such comments would reach him by Monday, February 4.

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ASTROPHYSICS SUBCOMMITTEE LETTER WRITING

Craig Hogan, chair

Craig Hogan identified 'below the line' topics on which the Subcommittee might comment; these included:

- Research and analysis: this, he said, needed to be pitched in terms of cost effectiveness and risk reduction

- Senior Review of projects: this, Hogan endorsed

- Planning for more frequent flights

- Tripwires

Christopher McKee urged tripwires be placed 'above the line'. He noted that Alan Stern appeared to have definite views on this; in the past, the Subcommittee had been somewhat skeptical. Heidi Hammel urged that the Subcommittee commend SMD for increasing the flight rate through SMEX. Andrew Lange commented that BEPAC had left open items in its wake; he remained uncertain as to the status of Beyond Einstein.

Kathryn Flanagan noted that half the current meeting had been devoted to discussing R&A; time might be better used if there was a Subcommittee working group to give advice on the subject. She believed such a group should be created, urging that it be viewed as resource rather than as a further advisory committee.

Christopher McKee said 'fallout' from Beyond Einstein affected the future of LISA. He described relations with the Europeans on LISA as 'delicate' – he urged that nothing be done to risk LISA given the possibility that it would rank high in the next decadal survey. Neil Cornish said McKee's view was consistent with the frequently expressed belief that capabilities should be maintained and missions readied for the decadal survey. BEPAC, Cornish added, had involved considerable time; use should be made of the entire document, not just its recommendation.

Kathryn Flanagan urged the location of Con-X not be left uncertain; without a clear 'parent,' it was likely to get starved.

Andrew Lange spoke in favor of eliminating one-project programs; this would provide additional transparency to the community. Neil Cornish noted that the Cosmic Origins 'stovepipe' currently had no follow-on mission; if a line was created, he said, the organizational chart itself suggested some successor to JWST should be created. Greene said considerable effort had been devoted to creating categories, including efforts to explain their significance to Congress. Cornish noted that while something might be termed an 'administrative arrangement,' once they were written down they had a life of their own.

Keck Agreement:

Craig Hogan, chair, asked the Subcommittee's views on Keck. Andrew Greene favored renewal of the agreement, though with certain concerns expressed. Hogan sought to clarify the group's position point by point. First, should the agreement be renewed? A consensus favored renewal. Second, should the scope of science done through Keck be broadened? A consensus agreed. Third, should the TAC process for Keck be moved to headquarters?

Discussion of this point ensued. Heidi Hammel said the present arrangement had been highly supportive of many NASA missions; she opposed making a recommendation on this point. Decisions about telescope access, she said, often needed to be made rapidly; the proposal, if adopted, might overburden relevant NASA personnel. Further, the agreement with NOAO would itself require creation of a TAC; therefore, no administrative time would be saved. Belinda Wilkes said if science use of Keck was broadened, a TAC with broader expertise would be required. Hammel questioned this, saying the TAC was selected by a single individual. Wilkes

said that individual would not know those working in the various communities. Hammel responded that only the person who selected the TAC would need to be educated.

Craig Hogan observed Subcommittee agreement on points one and two; these were the ones immediately pertinent. Hammel disagreed: she believed NOAO was anxious to move on the matter. Thomas Greene distinguished between the remaining points: point 3 was about who would administer NASA's Keck time; point 4 was about how much time there would be. On the question of moving TAC to headquarters, Greene said he regarded nothing 'broken' that needed repair. Zlatan Tsvetanov identified two reasons for the agreement: first, it would permit service to a broader spectrum of sciences; second, it would give NASA access to NOAO capabilities it did not currently enjoy. Greene said the proposal was not 'night for night' swap: NASA's Keck time for NOAO time. Clearly, Greene said, NASA would surrender half its Keck time; the advantage in return was uncertain. Brenda Dings said she believed the current Keck process worked well.

Heidi Hammel urged the Subcommittee to articulate and present its view to avoid being ignored; she doubted points 3 and 4 were in NASA's interest: NOAO was not sufficiently familiar with NASA science to evaluate appropriately NASA proposals for use of NOAO telescopes. Further, NASA would have no control over NOAO TAC members, who would have no obvious incentive to abide by NASA requests.

Craig Hogan said the generic argument for the proposal was that resources should be shared for best use; under this agreement, NASA would be doing its share. Lucy Fortson said NASA and NOAO were very different cultures; NASA proposals would be reviewed by people who thought in 'NOAO boxes.' Heidi Hammel said if the proposal was enacted, NASA priorities might be lost: further, reducing Keck time would harm non-strategic work, diluting NASA's overall science effort. Debra Fischer doubted application through NOAO would cause problems; she had made such application personally. However, she added, while returning Keck time to the community might be 'generous,' she doubted it would be in NASA's best interests. Hammel doubted that appointing two NASA representatives to the NOAO TAC would resolve the matter. Thomas Greene said NASA would continue to need its own TAC for assessing strategic and general applications. Christopher McKee asked if fixing the amount of time awarded to NASA projects would alleviate concerns. Greene said no; the real issue was that TAC review must be done by persons conversant in NASA science. Lucy Fortson urged the Subcommittee to be diplomatic in the language it used to express its views. Heidi Hammel suggested adding wording that encouraged NASA to evaluate, with the broader community, how NASA resources could be made more generally available. This wording met with general approval.

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ASTROPHYSICS SUBCOMMITTEE LETTER WRITING, continued

Craig Hogan, chair

SIM:

Debra Fisher said she viewed the decision to cancel SIM as political; SIM, she said, had successfully completed several Non-Advocate Reviews [NAR], which had included budget review. Craig Hogan agreed that SIM had cleared procedural hurdles: he believed, however, the 'political' aspect was that budgets had been reduced. Given that, he thought it preferable to proceed with missions from more recent science surveys than to 'grandfather' missions approved earlier. He did not

regard the argument: 'we followed the rules; therefore, support us' as compelling. Fisher said the choice had come down to SOFIA v. SIM; NASA, she believed, had an obligation to the scientists who had devoted the best years of their working lives to SIM. Andrew Lange said he was unaware of any scientifically correct process that led to SOFIA being chosen. Christopher McKee said, given the budget impact of JWST, NASA could not authorize another \$1 billion mission; effectively, he thought, SIM had been postponed until after JWST. Neil Cornish said a process issue was involved; that is, an 'end run' had occurred. Craig Hogan suggested the Subcommittee could aid NASA Administrator Michael Griffin by adopting an 'anti-earmark' position. Eric Smith observed that the community had learned perhaps too well of its need to talk to Congress; the community, he noted, also needed to learn to police itself. Lucy Fortson termed the SIM earmark a very bad precedent; it would encourage other projects to seek direct Congressional support. Cornish called attention to the American Astronomical Society criticism of this approach: this stated, in part, 'Pleadings outside this process are counterproductive... The AAS opposed all attempts to circumvent the process.' Subcommittee sentiment was to endorse the AAS language. Brenda Dingus urged adding language that the Astrophysics division was aware the impact the earmark would have on its own programs.

AMS Discussion:

On request, Jon Morse provided background on AMS [Alpha Magnetic Spectrometer]. The mission, advanced some years ago, would fly a giant magnet in space to show the universe was composed both of matter and anti-matter; recently, Congressional support for this undertaking had surfaced: the mission's fate was uncertain. Neil Cornish observed that the Congressional language on AMS did not declare the mission had to be undertaken, only that a mission evaluation had to be completed within 30 days. Eric Smith observed that, as all but one remaining shuttle flights was reserved for the ISS construction and supply, no apparent way existed to put AMS into space. Cornish noted that AMS had not been part of the 2000 Decadal Survey; he urged the Subcommittee to say AMS had no genesis, home or place in Astrophysics. Brenda Dingus expressed doubt that the Subcommittee could take that position. Kathryn Flanagan advocated AMS review within the 2010 Decadal Survey. Dingus said the Subcommittee could not know AMS would not be highly ranked. Cornish said AMS clearly did not reflect Beyond Einstein concerns. Heidi Hammel said AMS was not in any existing community-developed roadmap. Craig Hogan said no National Academy scrutiny of AMS had occurred. Cornish said AMS should enter the program only through standard processes.

BEPAC:

Andrew Lange praised the BEPAC report; in particular, the need to sustain development of the non-selected Beyond Einstein proposals for the 2010 Decadal Review. Neil Cornish urged that the Subcommittee not simply endorse the report, but urge everyone to read and be responsive to its recommendations. Eric Smith said the name 'Beyond Einstein' might be eliminated; this, Lange commented, would weaken the standing of individual missions. Cornish said he believed Beyond Einstein had been a successful theme; many in Congress were familiar with it. He noted that while 'people like to rearrange the deck chairs,' momentum was lost when names were changed; further, Beyond Einstein had served as a 'home' for other

ventures. Christopher McKee termed Physics of the Cosmos as a more general category; as such, it created a home for Con-X, which many doubted fit properly in Beyond Einstein.

Kathryn Flanagan said that, whatever concerns reorganization might prompt, she wanted the viability of the other Beyond Einstein undertakings to be maintained. Neil Cornish urged the Subcommittee to state explicitly that nullification of Beyond Einstein did not nullify the BEPAC recommendations. Christopher McKee suggested that the Subcommittee repeat each major BEPAC recommendation in its letter; this suggestion drew general agreement. Flanagan believed Physics of the Cosmos was too narrow: 'fuzzy' categories sounded attractive, she added, but any project not '100 percent owned' somewhere would likely be weakened. Belinda Wilkes stated that priorities were established by decadal surveys; in consequence, money went to missions, not to organizational boxes. She believed the BEPAC recommendations would help inform the decadal process.

Consolidation of Post-Docs

Craig Hogan noted the proposal to tie Post-Doctoral fellowships to mission categories, with each carrying a name [e.g., Einstein Fellow, Hubble Fellow, etc.]; he supported this change. Andrew Lange said that 'Hubble Fellow' was an established brand that carried 'panache.' Hogan saw value in freeing fellowships from particular missions. Brenda Dingus noted that having GLAST choose the GLAST Fellows tied the fellows' activities to that mission; re-naming might lead to a loss of mission-specific science. Neil Cornish said re-naming would avoid a proliferation of names. Dingus said new missions had a particular need for people devoted to them: if one received Chandra money; one should use the Chandra observatory. Heidi Hammel urged the Subcommittee to recommend that those selecting Fellows should be responsive to emerging missions.

Senior Fellowship proposal:

Eric Smith noted that the replacement of LTSA [Long-Term Space Astrophysics program] had eliminated its original intent; that is, to give people prestige positions that would lead to a faculty post. Heidi Hammel recalled previous discussion on the desirability of reducing the number of grants required to support a given scientist; these discussions, she said, led to the Distinguished Investigator to Enter New Field, to provide scientists with a two-year grant to investigate a new field. She said no effective way to administer this proposal emerged. Christopher McKee said 'senior fellowship' could not be defined to make only 'soft money' people eligible; if everyone was eligible, he added, a great many would apply. He questioned whether such a program would in fact produce significant incremental science; he preferred retaining the money in the R&A budget, perhaps placed in a separate pool.

Andrew Lange noted that senior researchers were less 'portable' than graduate students; he believed mixing graduate students across disciplines produced great benefits. On LTSA grants, sentiment was expressed that their five-year duration failed to ensure work of continued merit; it was noted that Jon Morse's Senior Fellowships proposal called for a three-year grant and possible two-year extension. Discussion turned to the various ways researchers were supported. Heidi Hammel said that for a 'soft money' scientist, a three-year grant was the opportunity to do serious research. Christopher McKee said that if NASA paid his full salary – rather than one-twelfth -- he doubted NASA would get twelve times the science.

Robert Clayton said if NASA paid his salary, the money would flow directly to the University of Chicago: the funds would not decrease his grant writing time, as this was devoted to supporting departmental post-docs. Hammel suggested that Yvonne Pendleton could make suggestions in this area as part of the R&A MOUW. This proposal was endorsed.

Tripwires:

Heidi Hammel said that for tripwires to be effective, they must be included in the Decadal Survey to demonstrate community 'buy-in'. Andrew Lange said that what was being sought was a factor – say, 2X of original budget -- that demonstrated the mission's original calculations were invalid. That threshold, Christopher McKee said, should prompt a project review that included the possibility of cancellation. Belinda Wilkes said the National Academy was the appropriate body for such a review. This, Eric Smith noted, would give the Academy descope authority for every mission. McKee urged earlier view of large missions: no one wished to acknowledge they had 'thrown \$1 billion down a rat hole.' Eric Smith said that while tripwires were generally a good idea, the 'the Devil is in the details.' Kathryn Flanagan noted that a project's costs increase the longer it remains in the 'queue': were missions to be accountable for 20-year old budget statements? McKee endorsed Hammel's suggestion that the 2010 Decadal Survey include tripwires; responding to Flanagan's point, he believed that whatever caused the overrun, the question remained of whether the science was worth it at the new price.

* * *

COMMENT: Jon Morse

Jon Morse thanked all those whose service on the NAC Astrophysics Subcommittee was ending with this meeting. He noted that the past several years had been a 'roller coaster' for the Subcommittee. He hoped members took pride in their contributions to the lunar initiative, even if these did not come to fruition. He believed the input the Subcommittee provided to NASA had been invaluable; as an example, he cited the value of the arguments presented on low-frequency radio, and he praised the high quality of the science discussion.

* * *

ASTROPHYSICS SUBCOMMITTEE MEMBERSHIP NEWS

Eric Smith
Executive Secretary
NAC Astrophysics Subcommittee

Craig Hogan, chair, invited members' thoughts on the Subcommittee.

Neil Cornish said the two previous years had been chaotic: each meeting received considerable information that differed from that previously presented; often, the decisions related to that information had already been made. He had valued the Subcommittee's role in defending R&A funding; progress had occurred, though the Subcommittee's advocacy might not have been the reason. In the future, Cornish added, the Subcommittee might wish, as the community's representative, to develop

and put forward issues of its own. He noted that at this meeting, matters had been brought to the Subcommittee prior to a decision on them having been made. Jon Morse noted that in the past, more working groups and other bodies had been available to give advice; now, NASA was emphasizing formal processes. This, Morse added, raised the Subcommittee's importance; it was the only existing Astrophysics committee and its comments needed to be listened to.

Craig Hogan noted discussion that, given the limits on Subcommittee time, working groups might be established to pass on information. Morse said the distinction between a standing group and an ad hoc group needed to be considered; likely, he said, a body analogous to the Universe Working Group could be revitalized. Brenda Dingus said the astrophysics community valued the Subcommittee's capacity to address NASA; in the Subcommittee's absence, she said, community members who had a concern – e.g. with the approach to Congress made by SIM – would have no avenue for expression. Heidi Hammel seconded this comment.

Thomas Greene said that when the Subcommittee was re-constituted, the community had doubts about its effectiveness; he believed this was changing. Jon Morse noted Eric Smith's advocating that the Subcommittee be given the flexibility it needed to do business. Greene thanked Morse for bringing forward the issues presented at the current meeting. Morse commented on Subcommittee scheduling: meetings needed to be held prior to NAC meetings; however, flexibility might increase if meetings were held more in advance of NAC sessions.

Jon Morse commented on NASA budget-making: this, he noted, was a year-round process. He said that in part because it was an Election year, the federal budget might not be completed by the October 1 start of the next fiscal year; in that case, NASA would operate under Continuing Resolution: funding would be as the previous year; no new initiatives could be undertaken. This, Morse said, was operationally 'painful.' In the meanwhile, NASA and Astrophysics would plan to the budget projections provided by the Administration and the Office of Management and Budget [OMB].

Brenda Wilkes asked what meeting schedule was best suited to putting forth the Subcommittee's views; Jon Morse noted that NAC next met in April 2008; the Senior Review report was due in May 2008. He believed spring was the most important time for presenting advice.

Heidi Hammel noted she was rotating off the Subcommittee. She urged two changes: first, that the Subcommittee be kept current on budget information; second, that the practice of presenting mission 'fever charts' be resumed: these, she said, presented considerable information in consolidated form. Christopher McKee said that while 'turmoil' may continue, NASA appeared to have settled down as an organization. He believed the Subcommittee would be more effective if more members of the astrophysics community were aware of the Subcommittee's members and how to contact them. Jon Morse said it was difficult to go beyond posting this information on various websites; he suggested AAS could post a bulletin announcement.

Brenda Dingus sought background on GLAST: at some point, she noted, the Department of Energy 'put its foot down' and directed that no further overruns occur. Jon Morse said GLAST was complicated, that complication partly reflecting the circumstance that the GLAST LAT team had needed to become educated in systems engineering for a space mission. Morse said that during his tenure at OSTP [Office of Science & Technology Policy], a 'lessons learned' document had been prepared, giving all an opportunity to vent. That experience, Morse added, underscored the

need for 'clean interfaces' when multiple bodies were involved: having 'two masters' proved costly. Morse said continuing learning was needed on how a successful partnership could be run. He noted that the issue of how GLAST overruns would be handled was being addressed in the MOU between NASA and DoE; further, he hoped to provide the Subcommittee with detailed information on the JDEM agreements at its spring meeting.

Jon Morse commented on the Astrophysics budget generally: the division, he said, had funds to undertake a mission that was Kepler-class in scope and complexity; therefore, that was what the division could do. The funds to do anything larger simply did not exist, Morse said, adding that it took continuing effort to impose budget realism on the community's expectations. He suggested members be aware that, by federal standards, a 'Kepler-class' undertaking was a very large project.

Robert Clayton noted that the joint Subcommittees meeting held two years ago had been highly useful; could such an event be repeated? Eric Smith said discussion of this recurred; the major obstacles were logistics arrangements and scheduling. Heidi Hammel seconded Clayton's comment, suggesting a joint session might be held biennially.

Jon Morse was queried about the Beyond Einstein designation: would it disappear? Morse said program labels should be transparent to persons with limited science familiarity; he did not believe the concept and the name had a shared fate. Morse praised the 'forward looking' approach taken by BEPAC. Neil Cornish asked the future of the Beyond Einstein office at Goddard Space Flight Center; Morse said this would be determined by top NASA management: however, he doubted any major change in the office's status would occur.

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SUBCOMMITTEE LETTER DISCUSSION:

Craig Hogan, chair, suggested 'walking through' with Jon Morse the major draft points of the Subcommittee's letter. Hogan noted points of consensus: the Subcommittee generally endorsed including tripwires in the 2010 Decadal survey; the Subcommittee generally endorsed renewing the agreement with Keck and extending the scope of science to be pursued there. He noted, further on Keck, Subcommittee doubts that NASA would benefit from enacting points 3 and 4 of the discussed agreement. On Keck, Jon Morse cited a need to put forward a plan with concrete details.

Further discussion on Keck ensued. Brenda Wilkes thought the case for undertaking points 3 and 4 was inadequate: 'why do this?' Thomas Greene said he thought concerns over moving the TAC to headquarters were addressable. Heidi Hammel agreed with Wilkes; she doubted points 3 and 4 offered NASA any benefit. Greene identified the concern that relocation of the TAC would lead to decisions being made by persons unfamiliar with NASA requirements. Neil Cornish suggested the Subcommittee include these points in its letter.

Discussion turned to the SIM earmark. Subcommittee consensus was to endorse the AAS language criticizing the securing of the earmark. Jon Morse expressed concern that a NASA committee would criticize an act of Congress, whose earmark this was. Craig Hogan noted that the criticism was not being directed to

Congress, but to the science community. Heidi Hammel said this issue was respect for the decadal process; she thought Subcommittee comment on this was fair.

Discussion followed on AMS. Craig Hogan said AMS had no clear connection to Astrophysics' science goals; the Subcommittee, he added, believed a National Academy review of AMS was appropriate. Neil Cornish noted AMS had never been subject to any decadal or peer-review process; this, Hogan commented, meant AMS had 'ever less heritage' than SIM. Jon Morse said NASA's current task was to execute the mandated study; this would happen soon. If, he added, the Subcommittee wished a review of AMS, the NAC would wish to be aware of that position. Eric Smith urged that any comment address the process, not the content of the SIM undertaking. Heidi Hammel seconded Smith's point; a declaration that SIM did not belong might be premature. Jon Morse restated the distinction between commenting on content and commenting on process: the former might suggest that NASA was attempting to control the outcome.

Discussion returned to Beyond Einstein. Jon Morse endorsed the BEPAC statement of the importance the science held to NASA's future work. He did not want any center to stop work on a candidate mission because that mission had not been selected.

Discussion turned to the proposed consolidation of Post-Doctoral fellowships. Craig Hogan reported Subcommittee concern that, if the consolidation occurred, new missions might lack the required post-doctoral 'horsepower.' He added Subcommittee doubts that the proposed Senior Fellowships would significantly add to the science work actually accomplished.

Discussion turned to the proposed Astrophysics reorganization. Craig Hogan asked whether -- and, if so, how -- the reorganization would affect Astrophysics priorities. Morse responded that, under current arrangements, every project threatened every other project. In general, he believed the 'natural home' of any mission was determined by its key science; large missions were inherently cross-cutting in scientific terms. Morse warned against things becoming 'pigeonholed' -- he did not favor removing Con-X from Beyond Einstein; perhaps Beyond Einstein was too narrowly defined. He had attempted to reassure those working on Con-X; he thought Con-X indispensable to Astrophysics science. Morse said it remained his view that Con-X was the next priority following JWST. Morse believed the 2010 Decadal Review of Con-X, Exo-planet possibilities, LISA and others would be highly important. He restated that the general purpose of the re-organization was to replace 'stovepipes' with an effective management tool; he wished to reassure people that programmatic balance would be maintained.

Several Subcommittee members expressed satisfaction with Jon Morse's action on various matters, including his bringing before this meeting various matters upon which no decision had yet been made.

The meeting adjourned Tuesday, January 29, 3:40 p.m.

Appendix A: NAC Astrophysics Subcommittee Membership

Craig J. Hogan, Chair
Astronomy Department
University of Washington

Eric P. Smith, Executive Secretary
Astrophysics Division
NASA Science Mission Directorate

Michael Cherry
Physics Department
Louisiana State University

Robert N. Clayton
Department of Geophysical Sciences
University of Chicago

Neil J. Cornish
Department of Physics
Montana State University

Brenda Dingus
Institute of Geophysics and Planetary Physics
Los Alamos National Laboratory

Debra Fischer
Department of Physics and Astronomy
San Francisco State University

Kathryn Flanagan
Kevil Institute for Astrophysics and Space Research
Massachusetts Institute of Technology

Lucy Forston
Adler Planetarium and Astronomy Museum
Chicago, IL

Thomas Greene
NASA Ames Research Center
Moffett Field, CA

Heidi B. Hammel
Space Science Institute
Ridgefield, CT

Robert C. Kennicutt
Institute of Astronomy
University of Cambridge
Cambridge, United Kingdom

Dr. Andrew E. Lange
Division of Physics, Math and Astronomy
California Institute of Technology
Pasadena, California

Fred K. Y. Lo
National Radio Astronomy observatory
Academy Sinica
Charlottesville, Virginia

Christopher F. McKee
Department of Physics
University of California, Berkeley

Belinda Wilkes
Harvard-Smithsonian Center for Astrophysics
Cambridge, MA

Appendix B: NAC Astrophysics Subcommittee Attendees

Monday, January 28, 2008:

Francesco Bordi, Aerospace
Andy Cheng, NASA HQ
Mike Cherry, LSU
Robert Clayton, University of Chicago
Dom Conte, General Dynamics
Neil Cornish, Montana State University
Michael Devirian, NASA JPL
Brenda Dingus, LANL
Gerald Fishman, MSFC
Kathryn Flanagan, STScI
Lucy Fortson, Adler Planetarium
Debra Fischer, SFSU
John Gantt, Mizrack & Gantt
Tom Greene, NASA Ames
Heidi Hammel, Space Science Institute
Andrew Harris, University of Maryland
Hashima Hasan, NASA HQ
Jeffrey Hayes, CUA
Craig Hogan, University of Washington
W. Vernon Jones, NASA HQ/SMD
Andrew Lange, NASA JPL/Caltech
Renee Leu, NASA HQ
Chuck Lillie, NGST
John Mather, NASA HQ & GSFC
Christopher McKee, UC Berkeley
Jon Morse, NASA HQ
Bill Oegerle, GSFC
Yvonne Pendleton, NASA HQ
Robert Peter, NASA GSFC
Michael Salamon, NASA HQ
Wilton Sanders, NASA HQ
Eric Smith, NASA HQ
Alan Stern, NASA
Zlatan Tsvetanov, NASA HQ
Kathy Turner, Department of Energy
Stephen Unwin, JPL
Belinda Wilkes, CFA
Jennifer Wiseman, NASA GSFC

Tuesday, January 29, 2008:

R. N. Clayton, University of Chicago
Neil Cornish, Montana State University
Brenda Dingus, LANL
Henry Ferguson, STSCI
Lucy Fortson, Adler Planetarium
John Gantt, Mizrack & Gantt
Tom Greene, NASA Ames
Heidi B. Hammel, Space Science Institute
F. Rich Harnden, NASA HQ
Jeffrey Hayes, CUA
Craig Hogan, University of Washington
W. Vernon Jones, NASA HQ
Andrew Lange, Caltech
Lia LaPrana, NASA HQ
Chuck Lillie, NGST
Christopher McKee, UC Berkeley
Bill Oegerle, GSFC
Yvonne Pendleton, NASA HQ
Wilton Sanders, NASA HQ
Eric Smith, NASA HQ
Belinda Wilkes, GET
Stephen Unwin, NASA JPL