

The NASA Advisory Council's Astrophysics Subcommittee
Fact-finding teleconference
NASA Headquarters
April 10, 2008

Introduction

The outgoing Executive Secretary of the Astrophysics Subcommittee (APS), Eric Smith, convened a teleconference for the purpose of introducing newly nominated subcommittee members. New members James Rhoads, Kimberly Ennico, Ron Polidan, John Huchra, Nick Suntzeff, Leisa Townsley (absent), James Manning, and James Kasting were introduced. The teleconference began at 1:00 PM Eastern time.

APS Status

Jon Morse updated APS on current activities in the Astrophysics Division (APD) of the Science Mission Directorate (SMD), including items from Fiscal Year 2009 (FY09) budget rollout charts, the February meeting of the Astronomy and Astrophysics Advisory Committee (AAAC), and follow-up results from previous APS meetings, as well as APS-requested stoplight charts for missions.

Budget highlights in President's requested FY09 budget include a number of initiatives. Among these are solicitation for Dark Energy Mission technology investment beginning in FY08, and the commencement of technological work for the Joint Dark Energy Mission (JDEM) in FY09. An Exoplanet Medium-Class mission will also be on the table, pending determination of an optimal budget.

APD continues to tie up loose ends with the Department of Energy (DOE) on technical work and is still supporting JDEM concept studies, and is currently soliciting technology through a Request for Information (RFI), preparatory to writing an Announcement of Opportunity (AO). There will be a cost cap imposed on JDEM in the Request for Proposals (RFP). The draft AO explicitly states that JDEM will remain a medium-class mission, with an Explorer-like cost envelope, but at a higher amount. To this end there will also be an evaluation of technology management and cost during the AO process, as cost control is vital on this and all other missions. Details are forthcoming. In response to a question, Dr. Morse noted that BPAC estimates constituted a robust upper limit on what might be required for this mission. NASA is investigating this internally as well. The bottom line is that JDEM cannot be a \$1B mission. The mission has already been assigned benchmarks, and its performance requirements are known. APD has a good idea of what it can buy for a medium-class mission.

In terms of the budget request, NASA had asked that the budget reflect the prioritizations instituted through the BPAC. As a consequence, LISA and ConX now have budget lines. The Einstein Program and similar programs are being supported by strategic mission concept studies. SOFIA's concept has become more like a ground-based observatory, and will have initial limited capabilities, which will be ramped up as engineering tasks and adaptive optics are completed. The hope is to begin early science observations in 2009, while involving the community and increasing capability and instrumentation over time. A solicitation draft should be released within a couple of months. In response to a question, Dr. Morse reported that the upcoming Senior Review will not consider missions in development, thus SOFIA will not be included within its purview.

APD continues to reinvigorate Research and Analysis (R&A), including the balloon and suborbital program. The top line of budget is decreasing, reflecting the commencing operations of the large missions Gamma-ray Large Area Telescope (GLAST), SM-4 and *Kepler*. The budget will hereafter go to other projects in SMD, and in the interim APD will switch its focus toward small impactful things that will enable the future. In response to a question on more expensive suborbital opportunities through the Stand-Alone Mission of Opportunity Notice (SALMON) vehicle, Dr. Morse felt that

while APD could react to a recommendation from the Decadal Survey, right now, the philosophy is that balloons should do balloons and Explorers do Explorers.

APD continues to fix R&A cuts that have affected the robustness of technology investment and science opportunities, including Theory, which is oversubscribed. Dr. Morse explained the apparent diminution of the total SMD budget, which by excluding overhead on projects, now reflects “direct dollars.” Thus the total SMD budget line is \$4.5B instead of \$5.5B. This change reflects a request from the FY08 appropriation. There has also been a transfer of Deep Space Network expenditures, which has been transferred from the Heliophysics Division to the Space Operations Mission Directorate (SOMD). The APD wedge is the largest in FY08, and then declines a bit, reflecting distribution of offsets throughout SMD.

The Astrophysics budget declines roughly \$200M from this year to the next as large missions launch and development dollars go off. This flat budget projection will be brought to the Decadal Survey planning committee. The effects of the new Administration cannot be predicted, but historically, the Bush Administration has been very steady as to the fractional increase of NASA budget going to Science: basically 1% a year, with some adjustments for inflation. The President’s budget request for FY09, however, will not change. NASA is just entering into the FY10 budget formulation process, which would be the next opportunity for any change. A committee member commented that the budgetary line is actually declining by 30% from 2008-13. Dr. Morse replied that some of that budget line is being held in Heliophysics (for future Explorers), but acknowledged the point. He directed APS attention to the thematic program content: Physics of the Cosmos, Exoplanets, and Cosmic Origins, to consider specific funds allocated to each category.

Significant recent events include the anticipated mid-May launch of GLAST. There has been an issue with Ku band transmitters, which is being resolved. The observatory has been delivered to the Kennedy Space Center, and final assembly is ongoing. A Delta II Heavy is the launch vehicle; crews are working issues with the second stage. They are also looking at reaction wheels, which failed early in the TIMED experiment. GLAST and *Kepler* use these same reaction wheels. The mission is considering operating the observatory with 3, 2, 1 or even 0 reaction wheels.

The James Webb Space Telescope (JWST) completed a Preliminary Design Review (PDR) on April 4, a big milestone. Most questions from a very large and augmented technical board centered around adequate testing and addressing technical risks. Polishing is being completed for the primary mirror. The Fine Guidance Sensor, contributed by the Canadian Space Agency, had their Critical Design Review (CDR) and passed it on the condition of further verification. *Kepler* is getting close to the Assembly, Test and Launch Operations (ATLO) phase, another huge milestone. The primary mirror installed, corrector and focal plane array (FPA) have been installed, among other components. Thermal vacuum testing of assembled photometer has been completed without anomalies. *Kepler* will next move to a higher level of integration testing with the spacecraft bus, but there will not be an optical test; instead there will be an end-to-end light test.

WISE, a MIDEX mission, is scheduled to launch in late 2009. The finite element modeling system had some errors and caused some damage to the test dewar during testing, thus the mission is recovering and identifying mitigating actions. The flight cryostat has been delivered but not tested, but this is still a big milestone. Efforts are under way to ensure the test dewar is intact before testing proceeds further. SOFIA has had some primary mirror test samples coated, and optical checks of the telescope system have been performed with Polaris. As planned, the telescope cavity aircraft doors have been removed, representing 6-8 months of downtime, with crews working 3 shifts to support the effort. NASA has outlined a framework with DOE on a basic acquisition strategy for JDEM. A memorandum of understanding will be completed in the near future, with a draft AO expected in the Summer. *Chandra*’s PIs won a Rossi prize for pioneering work on clusters, and *Chandra* data has been incorporated into Google Sky. Work is progressing on HST SM-4; gyros and batteries have been delivered and astronauts are undergoing Extravehicular Activity (EVA) training. Atlantis will be the

primary shuttle, and Endeavor will be the backup. The WFC3 camera is halfway through final thermal vacuum testing. Instrument performance appears to be good. COS underwent acoustics testing inside its carrier and is now undergoing post-test alignment.

Other future significant events include a nonadvocate review (NAR) for JWST, which will include schedule and budget. The outcome will be taken to the Program Management Council (PMC) in July, after which the budget converts to Nunn-McCurdy status for Congressional reporting. SOFIA's primary mirror will be flown to the Ames Research Center (ARC) for coating. NuSTAR will also move into development phase. Planck has provided instrumentation to ESA for a late October launch. SM-4 is scheduled for August. The upcoming Senior Review will evaluate all operating missions, with the exception of HST and FUSE (operations have ceased). HST will be reviewed after the outcome of SM-4 has been determined. HST and WISE may be reviewed next year.

Near-term events include a very active schedule in suborbital rockets and balloons from 2008- 2009. There will be an archival Senior Review in June. Dr. Morse displayed the stoplight chart and addressed a question about Herschel's budget cuts in the outyears. He noted that NASA was not cutting back on its commitment to community support and was in the process of scrubbing programmatic issues. For JWST, many things are happening- reviews, instruments, procuring flight hardware, testing, fabrication of mirror segments, all while battling low cost and schedule reserves. SOFIA is in a similar situation, but the issues appear to be tractable. *Kepler's* programmatic grade is yellow because of personnel issues, which are now resolved; it will be green next month. The red grade for Herschel reflects the impact of budget cuts- there are no technical issues. The FY08 budget is fine, but the outyears are a problem. Herschel and Planck are a little tricky because NASA is considering US-only contributions in the grading system, and thus does not reflect potential ESA scheduling problems.

ConX, LISA and JDEM are in pre-formulation stages, for which the schedule is very tight. WISE is yellow due to the aforementioned simulator issue. NuSTAR is moving to phase B and undergoing technology verification, and a flight demonstration that also has relevance for ConX. All operating missions are essentially green. *Spitzer* reacted to a DSN upgrade and suffered a small loss of data, as well as a minor IR spectrometer malfunction, but has reverted to normal operations. The Keck program now has an operations budget of ~\$3M/year, with key projects including an exozodiacal dust disk program, precursor science programs, and mission support for COROT and *Kepler*. The forward plan is to renew the cooperative agreement with the Keck Observatory. NASA is committed to retaining access to Keck, and is looking to open time to more diverse science categories that will be traceable to the goals of APD. The intent is to retain the same administration of PI process and archiving; the selection officer will be at HQ. NASA is also supporting the underlying infrastructure of the interferometer, as is NSF.

Top issues under consideration are preparations for GLAST, which may run into launch range conflicts with other launches in close proximity. There is a crowded manifest in 2008 and there will be a large ripple effect. External Tank delays may cause a slip of SM-4 slip by 4-6 weeks. The cost reserve posture of JWST remains a concern. Lastly, if WISE's flight cryostat is faulty, costs will rise.

In response to a question on the cost of JWST, Dr. Morse felt that he could not quantify an answer, but that warned that no large missions should be considered until JWST launches. In terms of John Bahcall's committee comments, the mission is ahead of their nominal curve, but not by much. In response to a question on a Congressionally mandated SIM mission, Dr. Morse predicted that a Flagship mission, with its required peak funding of \$300-400M in a given year, would effectively turn off many high-dollar operating missions and completely eliminate medium-class missions. The Decadal Survey is going to make some of these considerations. In the meantime, APD is trying to retain a balanced profile with healthy R&A, with a scientifically diverse portfolio aimed at achieving science goals. Consequently, NASA is considering a SIM-Lite concept as a lower cost way of achieving Decadal Survey goals. In addition, the Agency is also targeting exoplanet science, using astrometry or coronagraphy. As to the Alpha Magnetic Spectrometer (AMS), Congress has required

viability of launching AMS on an ELV, thus the probability of its being mandated is diminished, but it is not a closed issue. In the meantime, the Administrator has requested an NRC study on AMS vs. other Beyond Einstein-type missions. NRC said it will consider this in the context of Decadal Survey planning. An ELV launch requirement for AMS would have a great impact on the mission- at least \$400M to \$1B to take it apart for a different launch vehicle. A retrofitting would also take years.

Dr. Morse addressed the 40-50% cut in the Herschel budget, which did not include data analysis funds. Currently, APD is assessing the impact of the US contributions to the science center portion. The pain has been spread; *Spitzer*, *Chandra*, *Hubble* and SOFIA have also been cut to support priorities elsewhere in SMD. In response to a question about the Senior Review and the *Spitzer* mission, Dr. Morse explained that while both *Spitzer* and *Chandra* will be in the Senior Review, the budget implies a baseline only for *Spitzer*; i.e. a short warm mission through FY09 and then termination. *Chandra*, however, will continue. The Review will evaluate mission funding and determine the distribution of remaining funds for other high-priority missions. *Spitzer* already has a termination budget, and the cuts to *Spitzer* are large. In response to a question about comparing HST and SOFIA if they are being reviewed separately, Dr. Morse noted that APD evaluates budgets annually, and outyears are always changing. Performance capabilities of these missions must be understood before they can be subjected to review.

SOFIA will be evaluated at the point where an appropriate milestone can be identified in its science operations. There cannot be a fair review before it actually gets to its full science capability. No future missions in Cosmic Origins are on the table for this Senior Review, only the missions themselves, and around \$8M or so in the outyears. There is a very small amount of funding flexibility. APD future mission funds are likely to be absorbed into JWST as needed.

Asked to comment on the sudden departure of Alan Stern, Dr. Morse expressed his own sense of adjustment, similar to the reaction of other NASA staff. However, the interim appointment of Ed Weiler, a very familiar face in both the science community and NASA, is the best choice possible. There is no sense of how long he will remain in the position. In response to a question on the overall APD funding cuts, Dr. Morse explained that Earth Science, due to the accelerating pace of their Decadal Survey mission development, received some of those funds, as did an initiative in lunar science, to ensure a robust community to sustain across the election. Other programs had offsets, such as the Mars program, and many of these offsets are in the outyears.

Dr. Morse outlined the budget evaluation process to a new committee member, adding that the Senior Review needs to make choices based on the assumption that the bottom-third priority missions will be eliminated, if needed. For those missions not in the Senior Review, the outyear profiles remain the same, essentially.

NASA and NRC have come to an agreement on Decadal Survey funding; the process will be starting soon. He noted, importantly, that the next Decadal Survey will not have an influence on budget numbers. The top line budget is really a top-down assignment. The Decadal Survey is the opportunity to show exciting science, but one must be very cautious about budget assumptions. Dr. Morse did not expect a large deviation because of the overall federal budget constraints. That said, fiscal years 2011 and 2012 will be affected most by the Decadal Survey release in 2010. The AP community must be challenged to show its relevance to society. As an example, new physics enabled by astrophysics research has the potential to revolutionize technology, much like quantum physics discoveries of the past. Kudos and applause were extended to Eric Smith for his service as Executive Secretary and Hashima Hasan was welcomed back to her former position. Dr. Hasan requested emails from each member for the purposes of planning the next meeting. The meeting was concluded at roughly 2:50 pm.