

Astrophysics Subcommittee Meeting, January 9, 2009

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NASA ADVISORY COUNCIL

ASTROPHYSICS SUBCOMMITTEE

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Meeting Minutes

Hashima Hasan, Executive Secretary

Craig Hogan, Chairman

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Astrophysics Subcommittee WebEx meeting, January 30, 2009

APD Status

APD Director Dr. Jon Morse reviewed the APD status, beginning with the science budget by theme. While the current budget is still embargoed for FY09, Dr. Morse anticipated that the science top line may be increased considerably, but mostly in Earth Science. It is not yet clear what the transition and the subsequent budget request means for Astrophysics, as guidance for outyear funding is still to be determined from the Office of Management and Budget. APD hopes to have a FY10 budget release in March/April, at which time the James Webb Space Telescope (JWST) budget can be addressed in depth.

Timeline of missions

NuStar, Kepler, Herschel-Planck, Hubble Space Telescope Service Mission (SM-4), SOFIA, WISE, and LISA are in varying stages of formulation. There are ten operating missions at present, with many tools in space. The calendar year 2009 will be very busy for Astrophysics AP, including sounding rockets in Spring 2009. APD has just completed an Antarctic campaign with balloon experiments, and is participating in a Superpressure balloon development project with the Heliophysics Division. The Joint Dark Energy Mission (JDEM) Announcement of Opportunity (AO) remains on hold until discussions with ESA about a possible partnership have been completed. An Exoplanet AO is also to be determined, and will fall out of budget process this Spring. In the meantime the Decadal Survey (DS) is in process, thus APD must try to phase its activities with the community; this is likely to be a topic for the April APS meeting. Dr. Craig Hogan asked if this schedule would signify that JDEM might be ranked by the DS. Dr. Morse answered that as JDEM is not close to being in development, it will have to be ranked within the Decadal period; he expressed a desire to avoid repeating the fate of SIM, which suffered from colliding vague priorities and budget problems. Cost-sharing details between ESA and NASA on JDEM have yet to be resolved, however there are proposals on the table, tied to technology and budget.

Mission status

Herschel-Planck is Green, with a launch scheduled for April 16th. JWST is Yellow, reflecting its complicated nature, but this status is considered normal at the beginning of the flight hardware procurement period, and APD is working the problems within resources. In particular NIRCam performance across the field of view is being addressed, along with measurements and alignment issues. NIRCam and other instruments are due to be delivered in Summer 2010 and are thus in the critical path. SM-4 is a mixture of Green and Yellow, proceeding toward the May 2009 Shuttle launch. SOFIA is Yellow due to some ongoing work on cavity door software; the mission is augmenting and monitoring the vendor doing the software, which has set back progress a couple of months. In Exoplanet Exploration, Dr. Morse stressed that the rumored cuts to the Keck observatory program are not real. There are no changes planned, and the budget is at the level of previous APS recommendations and has been included in the President's budget request. In addition, per APS recommendation, access has been expanded, allowing additional science objectives to be entertained and reviewed. Dr. Morse offered to deliver a short presentation on Exoplanet Exploration at the next meeting, which Dr. Hashima Hasan noted for the agenda. APD is considering a SIM-Lite mission and has presented an independent cost estimate (ICE) previously to APS; the division is currently taking the inputs to the ICE exercise and applying it to other missions such as LISA, for transmittal to the DS committee. Dr. Hogan felt that this assessment was not an "apples-to-apples" comparison, as the technologies are not in the same stage of development. Dr. Morse replied that he was simply trying to ensure that the programmatic issues are homogeneous. The technology information, by contrast, will come from the projects and will be assessed by the committee. The Kepler mission is Green and looks good for March 5th, with some software development taking longer than planned, but which should not affect launch readiness.

IXO, LISA and JDEM are working up ICEs in preparation for the DS. Within the Explorers program, WISE is in ATLO phase, with its payload nearly assembled, heading toward a November launch. WISE's cost reserve issues have been resolved and there are no major technical issues. NuStar is in phase B, performing optics procurement for x-ray telescope, getting ready for a confirmation review, and scheduled for a launch in 2011. The Astro-H mission of opportunity for JAXA's Astro-H mission, is undergoing confirmation review at the Goddard Space Flight Center. The balloon program has had a successful campaign, and APD has completely recovered the payloads. A Superpressure Balloon test flight over the Antarctic has a good possibility of beating a record of 41 days aloft.

Operating missions

Operating missions are going well. A minor SEU event on WMAP did not affect science operations. The HST cryocooler for NICMOS has not come back to life, although attempts to revive it will continue for the next few weeks. Spitzer's IRAC cryogenics are due to run out in April, at which point the mission will shift to its warm phase (24°K) of science operations. The HST SM-4 mission has completed testing for science instrument C&DH and meeting milestones, with astronauts practicing their EVAs and learning to deal with possible anomalies. This month is pivotal for SM-4.

Dr. Morse briefly reviewed the Hubble EVA schedule. SI C&DH is slated for day 1, having displaced battery repair (which was moved to day 5). The ACS repair will probably be performed on day 3, with a possible revisit on day 5; John Grunsfeld feels he has the repair well in hand. SOFIA has completed end-to-end line operations with the HIPO instrument, was represented at a recent AAAS workshop, and has hosted visits at its facility, which will be good for both science and Education and Public Outreach. WISE's solar array has been mounted on the spacecraft. JWST's flight mirrors are being cryotested, and a rebuild of its flight cables is under way. The ISIM is being assembled, with roughly half the decks having been bonded. In addition, a communications upgrade in the Deep Space Network has been performed to accommodate data transmission.

Dr. Morse provided some balloon data, including altitudes and masses of payloads, for CREAM IC, ANITA II, and an ultra-long duration balloon (ULDB) carrying a 1500-lb payload at about 111k feet. Mid-latitude tests are being planned in the next phase of balloon flight development. Astrophysics outcomes have been well represented in the media, accounting for appearances on many 2008 Top 10 lists, including Scientific American, Time Magazine, Space.com, Astronomy Magazine, Discovery Magazine, etc. Numerous press releases in astrophysics have also been held since the last APS meeting. Highlights included light detection of exoplanets by HST (Fomalhaut B), Chandra dark energy findings, Fermi pulsar detections, and galactic center surveys. Initial SMEX and mission of opportunity (MoO) selections have been made- these are JANUS, GEMS, TESS, CPEX, IRIS, NICE, and SXS, a MoO for NEXT. Site visits will continue and downselection will occur in the Spring. Astrophysics Fellowships were detailed: the Einstein Fellowship received 156 applicants for 10 slots, the Sagan Fellowship received 51 for 5-6 expected slots, and the Hubble Fellowship received 237 for 17.

Addressing cost growth issues and lessons learned, Dr. Jack Burns interjected a brief comment to the effect that the NAC Science Committee has been considering a Lessons Learned Task Force, composed of external experts, to focus on the decision tree that has led to missions that have exceeded cost caps, such as Mars Science Lander, JWST, and other missions in other divisions. Dr. Morse reviewed Astrophysics budget categories, projections for missions in development and operations, and research grants. A committee member noted that the charts seemed to indicate a reduction in research grants. Dr. Morse explained that as missions fade away, the chart trends down in outyears. Dr. Morse agreed to provide similar charts for the use of the DS committee as well as extra input associated with the coming FY10 budget. Dr. Hogan asked if operations and Guest Investigator support was included in these numbers, and Dr. Morse promised to clarify the numbers off-line. Dr. Morse also briefly showed charts

representing missions in development through FY10, as a fraction of budget vs. years, and was also asked to make further clarifications on whether these charts included suborbital missions.

Dr. Morse reviewed JWST's cost history, annotated with decisions and cost environments such as industry changes, NASA cost growth, and the Ariane delay. A participant noted his preference for a second set of points that would be tied to uniform dollar values. Dr. Morse replied that a complicating factor is the transition from cost to full-cost-accounting, and therefore he had deliberately used an "advertising cost" unit in an attempt to reflect what the Agency had been saying to the community. The real-year dollar sums change as one goes forward. He noted the JWST schedule trend that the launch date had been slipping one year per year, and offered to provide overall year-by-year cost to APS. Dr. Hogan agreed that this information would be relevant data and helpful. Dr. Morse noted that JWST had spent about \$1.B through phase B; 40% of the development budget had been spent before confirmation. In this context, however, he did not expect JDEM to slip year to year for 5 years. The JWST pattern reflects the complexity of the mission. Responding to a comment referring to lessons learned about holding off on hiring an engineering staff (marching army) until technical problems had been solved, Dr. Morse conceded that there were some post-development costs associated with JWST mirrors. Notwithstanding, there does not appear to be a correlation between budget expenditure before confirmation and cost growth in APD.

Dr. Morse presented informational slides on Supporting Research and Technology SR&T, showing that the division has been working its way forward in restoring total R&A, as long as budget guidance allows. He also provided a chart depicting a ROSES 2007 review.

Questions from APS

In response to a question, Dr. Morse provided some details on an upcoming, Congressionally mandated, National Research Council (NRC) review of the suborbital program at NASA, including the airborne program in the Earth Science Division. SOFIA will probably not be included, but balloons and sounding rockets will be. He invited APS to provide inputs. The NRC's charge is to evaluate the effectiveness and future science value of the program. There was no current information about the composition of the committee, but Mr. Greg Williams offered the additional insight that the NRC would consider the importance of suborbital activities in training the next generation of scientists, and in building a better workforce. Moreover, any input should convey how the program helps NASA meet its science objectives.

Dr. Morse was asked if there were any plans in work for an Exoplanet R&A program, and if not, where the home of exoplanet proposals resided. Dr. Morse responded that APD was not planning to have a specific research program, but pointed out that the Astrophysics Theory program allows such proposals, as does the Origins of Solar Systems (co-funded by the Planetary Science Division). APRA was also cited as an area of relevance. It was mentioned that a past Senior Review had recommended that the current structure as a means of allowing self-correction. In response to a comment that there had been a concern about the quality/appropriateness of review panels for some proposals, Dr. Morse expressed confidence in the Origins of the Solar System panels, as well as those of HST, Chandra and Spitzer.

Dr. Morse addressed the availability of expendable launch vehicles and cited a Congressional report in progress on the issue, adding that APD should keep an eye on Falcon and Taurus II vehicles. The report bodes well for Astrophysics and may allow a move toward a MIDEX AO in the near future. For very large missions like JDEM, however, APD will have to see what future holds. Dr. Morse also noted that some Astrophysics activities are being funded by the Planetary Science Division and the lunar program, due to some overlapping interests.

JDEM Update

Dr. Morse prefaced the presentation with some remarks to the effect that the European Space Agency (ESA) has ranked dark energy as a high priority, and has presented the ESA EUCLID mission as their large dark energy concept. A downselect is due in the ESA Cosmic Visions program later this year. The EUCLID mission is nominally described as a medium mission but is in fact very large. NASA and ESA have some work-share proposals on the table with respect to this mission. ESA needs to talk to its science program council, and NASA will hear back from them in about a week. NASA hopes to identify a path forward, together or alone, in the next few weeks. It would be very enabling to partner with ESA, not just in budget terms but with more science expertise added within a partnership.

Dr. Neil Gehrels presented JDEM objectives and details as currently envisioned. JDEM would be placed at Lagrange point 2 (L2), and launched on an EELV, mid-decade (2015, roughly). JDEM is envisioned as a precision cosmology experiment and a powerful astronomical observatory. It would yield five years of a primary Dark Energy mission as well as an extended phase of peer-reviewed observations for ancillary science. The mission is designed to provide a tenfold improvement on equation of state parameters, and to provide information on the measurement of the cosmological constant, theory of gravity, the nature of dark matter, data on neutrino mass, and possibly data to support the Superstring theory. Measurement techniques will span weak lensing, Baryon acoustic oscillations (BAO; essentially a 3-D survey in redshift), and supernova studies, the latter meant to push supernovae observations into the realm of the near infrared (NIR).

The advantage of JDEM's L2 placement include no blurring from the atmosphere, no background interference, a stable orbit at L2, whole-sky coverage, and precision through repeated measurements. The time is right for JDEM both scientifically and technically. Its technological advantages include large-format charge-coupled devices (CCDs) and mercury-cadmium-telluride detectors; wide-field, lightweight telescopes; and high-TRL technologies. Dr. Hogan remarked that JDEM can also function as a finder telescope for JWST.

JDEM capabilities, spurred by supernova discoveries and discoveries related to the expansion of space, have been accelerated by these events. In the Summer of 2008, NASA and DOE formulated JDEM as a strategic mission, and established a NASA JDEM project office at GSFC, as well as a DOE project office at Lawrence Berkeley National Laboratories. The JDEM Science Coordination Group (SCG) was also formed at that time. Theoretical studies, the findings of the Dark Energy Task Force (DETF; 2005), and the Figure of Merit Science Working Group (FoM SWG); have also contributed to the formulation of the JDEM mission concept. The SCG has 17 members chosen from the Astrophysics and particle physics communities, and will hold its final meeting February 3-4 of this year. A reference mission configuration is coming to finalization. Dr. Hogan asked if a reference mission might change depending on ESA discussion outcomes. Dr. Gehrels responded that this was a possibility, adding that while NASA and ESA have very similar mission concepts, there are also significant differences. In response to a question as to whether the three proposed techniques increase mission complexity prohibitively, Dr. Gehrels responded that weak lensing may be the most challenging technique in terms of optics, while also stating that he believed it could fit in a \$1B mission. Dr. Grady added that much of the work performed thus far was concentrated in preventing the payload from becoming too complex. Dr. Morse added, that at the division level, he knew it would be messy, but that there were overlapping capabilities, with engineering feasibilities that will be described in the AO. NASA will react to the peer review process in how it will weight these capabilities, which could change as NASA reacts to the AO. Dr. Hogan expressed his satisfaction with the process of optimizing JDEM's mission design. Dr. Morse noted that APD must make sure the budget matches content, and that ESA's participation may be the key to mission success. If JDEM cannot rely on ESA involvement, NASA will have to cut back on the capabilities of the mission.

In response to a question on the JDEM selection process, Dr. Morse was asked how conflicts of interest could be guarded against. Dr. Morse replied that APD has sent a letter of intent describing how it will solicit JDEM science; i.e. from supernovae, Weak Lensing and BAO experts, along with other techniques. This solicitation will help JDEM assemble a science working group in which these priorities can be selected judiciously. Dr. Hogan noted that JDEM's ancillary science is also very important. Dr. Morse assured APS that APD will ensure that JDEM data becomes generally available, and that NASA intends to have broad community participation in the mission in several forms, including interdisciplinary efforts. APD will also ensure that data is archived and made accessible through funded research, the GI program, and proposals for different scientific uses. Dr. Gehrels added that the SCG is writing a very thorough final report that will be used as a basis for any configuration adjustments due to de-scopes. The external opinion of JDEM planning is that it has been a good and unbiased process.

Kevin Grady reported on JDEM's programmatic status. The mission formed a project office last Fall, and the near-term plan is to have an AO release in the Spring. The Science Working Group will be composed of science investigation leads, and phase B (preliminary design phase of 14-15 months) will start in roughly January 2010. The effort is now concentrated in building a mission concept around the reference mission. A Mission concept review (MCR) is targeted for March of this year, which will kick off the phase A trade study to optimize all the elements of the mission, probably consuming most of calendar year 2009. A system requirement review and mission definition review will be held after the phase A trade study. Dr. Gehrels noted that the mission will also deal with DOE and non-advocate reviews. The end of 2015 is considered an optimistic launch date, pending funding and programmatic issues with ESA. Dr. Morse noted that the official answer is "mid-decade." Dr. Hogan asked if the MCR were comprehensive. Dr. Grady replied that the MCR is not optimized by any stretch. Dr. Hogan asked for assurances that the project was considering extracting the science answer. Drs. Gehrels and Grady responded that there will indeed be an overview of science, data processing, archiving, and ground systems capability. Dr. Morse added that the NASA philosophy is to avoid under-scoping the data analysis part. JDEM is a serious effort that will include specific guidance in the AO. DOE and ESA will also bring influence and resources to the mission, as well as additional opportunities for science return. Dr. Gehrels noted that ground-based efforts are planning a complementary role, to liberate JDEM from having to do everything.

In addressing additional issues, Dr. Burns requested that subcommittee chairs update their progress with the quarterly update on the NASA Operations Plan.

Dr. Hasan reminded participants to observe and promote the International Year of Astronomy (IYA 2009), a worldwide celebration. NASA has already had a kick-off, beginning with the unveiling of a NASA M-101 image. She encouraged participants visit NASA's IYA website, particularly a section containing NASA's IYA student ambassadors, comprised of one student from each US state and its two territories. During SM-4, John Grunsfeld will be taking an IYA banner to the Shuttle. NASA is also planning events for NASA astronauts upon their return from SM-4, along with many events for the public throughout the year. Dr. Hogan concluded the meeting shortly before 3PM.

Appendix A
Attendees

Participants

APS members on telecon:

Craig Hogan (APS Chair) Hashima Hasan (APS Executive Secretary), Belinda Wilkes , Debra Fischer, Fred Lo, Ronald S. Polidan, Kimberly Ennico, CM McKee, Leisa Townsley, John Huchra, Jim Kasting, Andrew Lange, Rob Kennicut, Jack Burns (NAC Science Committee Chair)

Presenters:

Jon Morse (Director, Astrophysics Division), Neil Gehrels (GSFC)

Observers at HQ:

Wilton Sanders (HQ), Thierry Lanz (HQ), Azita Valinia (GSFC), Patricia Boyd, Marian Norris (HQ)

Observers on telecon:

Jennifer Wiseman (GSFC), Kathy Turner (DOE), Richard Griffiths (HQ), Kevin Grady (GSFC), Lia LaPlana (HQ), Nigel Sharp (NSF), Michael Devirian (JPL), Dan Lester (University of Texas, Austin), Timothy Lee (ARC), Greg Williams (HQ)

Appendix B
Membership Roster

Craig J. Hogan, Chair

Fermilab
University of Chicago

Kimberly Ennico
NASA/Ames Research Center

Debra Fischer
Department of Physics and Astronomy
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Kathryn Flanagan
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Appendix C

Presentations

1. Astrophysics Division Status [Morse]
2. JDEM Update [Gehrels]