

James Ulvestad presented an update on AST activities. He aims to achieve a scientific program that is balanced between the major facilities, mid-scale programs, and individual investigator programs within fairly constrained budgets. Since the May 2013 AAAC meeting, key Division activities have included the release of the Mid-Scale Innovations Program (MSIP) solicitation, the re-baseline of the Advanced Technology Solar Telescope (ATST) as approved by NSB (increase in costs due to site access delays), the start of the Dark Energy Survey (DES), and the first light of the Gemini Planet Imager (GPI) earlier this week.

NSF meets frequently with the DOE in discussions on the Large Synoptic Survey Telescope (LSST) and the Dark Energy Spectroscopic Instrument (DESI) experiment plus the agencies have semi-annual LSST meetings with the Office of Management and Budget (OMB) and the Office of Science and Technology Policy (OSTP). AST program officers have also been meeting semi-annually with NASA Astrophysics Division program officers. In response to the decadal survey and the portfolio review, a solicitation was released on MSIP. The funding requested in FY 2014 is \$7M but total funds available will be dependent on budget outcomes. AST has requested a Committee on Astronomy and Astrophysics (CAA) study on the ground-based Optical/IR System. AST has been working with the CAA and the National Research Council (NRC) on a statement of work for the committee and a proposal is being reviewed right now. AST is not ready to commission a mid-decadal survey

Ulvestad provided some programmatic and science highlights. There has been a lot of work done on Haleakala for the ATST. ALMA was inaugurated in March. The last antenna was accepted in September and the Cycle 2 call for proposals is out. The Gemini Planet Imager, a seven-institution collaboration, was installed on Gemini-South in August. First light occurred on November 11. The instrument will be imaging Jupiter-like planets. It has a low-resolution spectroscopic capability. The campaign will be started in 2014 and public availability is expected in 2014.

LSST is a joint NSF/DOE project. The goal is to start NSF construction in July 2014. The DOE camera could not start in FY 2013 due to the Continuing Resolution, but it is in the FY 2014 budget request. The NSF Final Design Review (FDR) is planned for December 2013. AST is aiming for approval of a construction award by the National Science Board at their May meeting (LSST FDR originally scheduled for late October; delayed due to the lapse in appropriations). Good technical progress continues on the primary-tertiary mirror. The secondary mirror contract is in place, the telescope mount assembly bids are in hand and the summit facility construction RfP has been released with bids due in January. There has been good progress on the data management part of the project. There has been processing with simulated data.

Another joint project has been the Theoretical-Computational Astrophysics Network (TCAN) program with NASA. A total of 108 proposals were submitted. Both NSF and NASA made three awards, totaling \$1.5M over three years. NASA is in the process of making their three awards using FY 2014 funds.

The Dark Energy Survey (DES) is a NSF/DOE collaboration. NSF is in charge of the data management system and telescope operations and DOE supplied the camera. It is a five-year survey that began in August 2013 (525 nights).

Ulvestad described the budget situation. The NSF FY 2013 budget was \$232.5M, a 2.5% cut to research and related activities relative to the FY 2012 budget. This resulted in a 4.5% reduction within the MPS Directorate. NSF stated early in 2013 that early career programs, research infrastructure and existing awards would be protected. Because of the large facilities, the AST

budget had only a 0.9% reduction relative to FY 2012 (the Physics and Mathematics divisions were hit particularly hard). There were decreases in the facilities per the FY 2013 President's Budget Request (PBR); the National Optical Astronomy Observatory (NOAO) was decreased in FY 2012. There were no new mid-scale projects. Some forward-funding actions were performed to clear some space for the MSIP in 2014. Future commitments with the individual investigator programs were kept at conservative levels. In the grants programs, there were 637 projects proposed with 90 awards (a 14% funding rate). The Division is anticipating funding rates near 10% in the near future which is of great concern. Options are being considered.

Geoff Marcy commented that the MSIP program is vitally needed and the AAAC should somehow support the NSF in funding the program.

Because of the lapse in appropriations, the LSST FDR was postponed from October to December. National Radio Astronomy Observatory (NRAO)-North America had to shut down because of a lack of FY 2014 funds and several other facilities were close to depleting their FY 2013 funds.

There is strong support of NSF overall in the FY 2014 PBR. LSST funding is requested in the Major Research Equipment and Facilities Construction (MREFC) line and there is a mid-scale innovations program start. The House and Senate committees used different funding assumptions and thus produced different budgets for NSF. NSF hopes that Congress fully supports the FY 2014 NSF budget request, which AST is prepared to execute. In the event of sequester, or a CR near sequester levels, expectations are that the protections of research infrastructure at the expense of individual investigators would not be repeated. Research facilities would share at least proportionately in any budget reductions. For AST, this could mean a significant budget reduction relative to FY 2013 levels.

AST advertised that divestment decisions will be made "near the end of CY 2013." Decisions will require consideration of alternatives in compliance with the National Environmental Policy Act (NEPA), the National Historic Preservation Act (NHPA), and the Endangered Species Act (ESA). AST must consider in a public way any alternatives. AST is preparing a Dear Colleague letter to the community that will discuss alternatives and next steps. AST is having partnership discussions with other agencies, universities, etc.

Paul Hertz presented an update on NASA activities. This remains a time of scientific opportunity for NASA Astrophysics. The budget for NASA astrophysics, which includes JWST, is at a high level. NASA continues to operate large and small space-based observatories spanning the electromagnetic spectrum, including multiple Great Observatories. The James Webb Space Telescope (JWST), the highest priority of the science community, is on schedule and fully funded for an October 2018 launch. NASA continues to develop contributions to international missions for launch this decade. NASA has down-selected two new Explorer projects to begin development for launch in this decade. NASA continues to support individual investigators for data analysis, theory, and technology investigations through open, competitive, peer reviewed processes. NASA is preparing for the strategic mission that will follow JWST.

However, the budget future for astrophysics remains uncertain. The FY 2013 rescission and sequestration have had a real impact on programs. The constrained budget request for FY 2014 and the planning budget for FY 2015-FY 2018 means priorities must be set and choices must be made. The reduced funding under the FY 2014 continuing resolution, and any further reductions due to a FY 2014 sequestration, will require difficult choices. The impacts of the government shutdown and an unfunded restoration of education and public outreach programs have added

additional pressure to the budget. There are many competing pressures on the budget and this affects the fraction of the NASA budget that is devoted to science and to astrophysics.

The Astrophysics Division is using the science priorities from the 2010 Decadal Survey to guide its strategy. But there is not an adequate budget to implement the recommendations as written. In the absence of any new missions, progress against those decadal survey priorities are maintained through the core program that includes research and analysis, support for technology development, operations of existing missions and their guest observer programs, the suborbital program, and Explorer opportunities. The goal of this strategy is to have a new strategic mission started as soon as funding is available after the launch of JWST. To prepare for a new mission, near term programs of science definition teams, mission concept studies and technology development are being undertaken with the goal of informing a mid-decade decision. Moderate missions are being studied, in addition to a large mission such as the Wide-field Infrared Survey Telescope (WFIRST). Several mission concepts are derived from the science objectives of the prioritized missions and recommendations in the decadal survey: Astrophysics Focused Telescope Assets (AFTA), WFIRST, an X-ray astrophysics probe (addressing IXO science), and an exoplanet probe (moderate mission using internal or external occulter).

The government shutdown had a major impact on NASA programs. The 2013-2014 Antarctic long duration balloon campaign was cancelled. The shutdown came at a critical time and there was insufficient resources and time to prepare the McMurdo station and the payloads for launch after the end of the shutdown. SOFIA cancelled nine science flights with US instruments. There was a stand down in the Astro-H soft x-ray spectrometer integration and test. Other development projects had schedule hits including one month on the ISS-CREAM payload. Operating missions continued most activities but there was some delay in science data processing. There were also delays in sending out research funding.

Hertz gave an update on JWST. All of the optics for the telescope are complete. Fifteen flight primary mirrors and the flight secondary mirror are at NASA-Goddard in storage; spares are in storage. All eighteen flight mirrors will be in storage at Goddard by the end of the year or early 2014; they'll be needed in 2015. The Backplane Support Fixture (BSF) and the Center Section (CS) are undergoing cryo testing (this is on the critical path in the schedule). All of the instruments for the telescope are at NASA-Goddard. Several reviews are being done leading up to a spacecraft critical design review. The project has entered its long and challenging integration and testing activities. The project is performing within the budget and schedule. FY 2014 is the peak funding year with many critical activities.

Hertz gave an update on Kepler. The flight system is behaving nominally in a point-rest state. The Call for White Papers resulted in forty-two submitted papers covering exoplanets, asteroseismology, open cluster studies, near earth objects, and more. The preliminary results of the Kepler project's science recommendation was delivered to NASA in October; a final report is due in November. A series of engineering demonstrations of 2-wheel performance on the spacecraft was initiated and a report is due in mid-November. The report will be independently reviewed for both science and cost/technical feasibility. In early December, NASA will respond to the project with either an approval to continue working on the Senior Review proposal or a decision to terminate Kepler if the 2-wheel operations are determined to be scientifically noncompetitive, technically infeasible, and/or cost prohibitive.

Since Fall 2012, NASA has been studying potential uses of the 2.4m telescope assets. The focused astrophysics study showed that the use of the telescope assets can fulfill the mission requirements of WFIRST. For approximately the same costs, the telescope assets would enable a

WFIRST mission with significantly improved science capabilities relative to the design described in the Decadal Survey. The NASA Administrator directed the Science Mission Directorate to continue pre-formulation activities for a mission using 2.4 telescope assets to prepare for a later decision as to whether a WFIRST mission would be undertaken with these optics. No decision on a future wide field infrared survey mission is expected until early 2016 and no decision to proceed with design studies for any other concepts has been undertaken. NASA has requested an NRC study in late 2013/early 2014 to assess the AFTA design reference mission against the Decadal Survey recommendations for WFIRST.

NASA has expressed strong interest to the European Space Agency (ESA) in contributing to ESA's next astrophysics missions insofar as they are as responsive to the US Decadal Survey as they currently appear.

The Astrophysics Division will conduct a Senior Review for their operating missions in the March 2014 timeframe. The missions invited to the Senior Review include Hubble, Chandra, Fermi, NuSTAR, Spitzer, Suzaku, Swift, XMM-Newton, and possibly Kepler, Planck, and WISE.

In FY 2013 Congress appropriated \$659M for the Astrophysics Division and \$638M for JWST. The Astrophysics appropriation total matches the request but includes \$10M for WFIRST. The JWST appropriation is what was requested. With the rescission and the sequestration and other budget adjustments, the FY 2013 Astrophysics budget was significantly lower. The budget ended at \$617M. Astrophysics made reductions totaling \$42M that included reduced carryover operating missions, development slowdowns for current and future Explorers, and postponement of infrastructure program upgrades. The FY 2014 PBR for Astrophysics is \$642M with \$658M for JWST. The request does not include any funding for education and public outreach activities.

Cost profiles are developed for all missions. Some of the numbers can be changed but there is not a lot of flexibility. For example, the costs for SOFIA are what they are because it cost more to operate a telescope in a plane rather than on a satellite; it has a different set of cost requirements than a satellite. Now is the time that SOFIA is reaping the science benefits. Fermi was able to keep its guest observer program by reducing costs within that program.

Kathy Turner gave an update on DOE activities. The High Energy Physics program's mission is to understand how the universe works at its most fundamental level. To enable discoveries, HEP supports theoretical and experimental research in both elementary particle physics and fundamental accelerator science and technology. The DOE Office of Science is a science mission agency. The FY2014 PBR for High Energy Astrophysics is \$776M. The current FY 2014 funding plan is based on the continuing resolution through January 15, 2014 with a FY 2013 "bottom line" budget of \$748M. HEP was not able to start fabrication on new projects in FY 2013 and the only one that is being requested for a fabrication start in FY 2014 is the LSST camera. Several new efforts are delayed and continue in the R&D phase [LHC upgrades, Long Baseline Neutrino Experiment (LBNE), 2nd Generation Dark Matter detectors, and DESI]. The LSST camera did not receive approval in FY 2013 but is requested again in FY 2014.

DOE receives program guidance from external FACA panels such as HEPAP and the AAAC. The U.S. High Energy Physics (HEP) program follows a strategic plan laid out by the previous HEPAP P5 subpanel studies that were done in 2008. DOE is currently engaged with the science community in developing a new strategic plan through the Snowmass/P5 process that started in 2013. P5 will assess and prioritize the HEP projects over a 20-year timeframe within a reasonable budget.

Through ground-based telescopes, space missions, and deep underground detectors, research at the cosmic frontier aims to explore dark energy and dark matter, which together comprise approximately 95% of the universe. The FY 2104 PBR is \$91.034M for the Cosmic Frontier.

Currently the Dark Energy program consists of the Baryon Oscillation Spectroscopic Survey (BOSS), DES, and the supernova surveys. There is some science effort on WFIRST and Euclid but no plan for participation in the projects. LSST is the priority for the next HEP dark energy project to be developed. NSF is the lead agency responsible for the telescope and data management; DOE is responsible for the camera. Future planning may include DESI. DOE and NSF talk regularly about possible opportunities, constraints and models for the experiment and use of a telescope facility. DOE also funds experiments measuring properties of high energy cosmic rays and gamma rays such as the Alpha Magnetic Spectrometer (AMS) experiment onboard the International Space Station, the Pierre Auger Observatory, the Fermi Gamma-ray Space Telescope (FGST), the Very Energetic Radiation Imaging Telescope Array System (VERITAS), and the High Altitude Water Cherenkov (HAWC) gamma-ray observatory. There is also an extensive program in direct-detection dark matter experiments.

Geoff Marcy asked whether there was some commonality in staff between the BOSS and DESI project; if there is no funding for DESI this year, some people may have to leave the consortium. Turner replied that there is some overlap in staff but R&D funding for DESI continues in hopes of getting fabrication started. Data analysis for BOSS will go on for a while.

Angela Olinto wanted a clarification on using the Mayall for DESI. Both Turner and Ulvestad replied that discussions are on-going and options are being explored.

Mordecai-Mark MacLow asked about what is happening outside the DOE Office of Science in the area of astronomy and astrophysics and suggested that at the next meeting, DOE provide a few slides on those activities. Geoff Marcy noted there may be some missed opportunities for coordination that if the committee had known about them, they could have provided some advice.

George Helou (IPAC, Caltech), gave a presentation on lessons learned from past and current ESA-NASA partnerships. IRAS was the first IR all-sky survey and was a collaboration between the U.S., the Netherlands, and the UK. It introduced the first large uniform data sets available. The Infrared Space Observatory (ISO) consisted of four versatile instruments (2 imagers and 2 spectrometers). This was an ESA-only mission with some US individual participation as co-investigators on instrument teams and on the ISO science team. The US community was responsible for ~25% of ISO time. The NASA Astrophysics investment was all in data analysis funding and community support at IPAC. This was an ESA mission with minor NASA participation. Spitzer, a NASA infrared Great Observatory was launched in August 2003. The time allocation committee included non-US scientists and all calls were open worldwide. European scientists were responsible for ~20% of open time on Spitzer. Herschel, an ESA mission with significant NASA contributions, was launched in May 2009. NASA's primary participation was in enabling detector technologies for two instruments; instrument participation resulted in access to guaranteed time (GT). Open time calls on Herschel resulted in U.S. PI's carrying about half of the open time, in addition, to GT participation. Planck, an ESA mission with significant NASA contributions, launched in May 2009, was to conduct a state of the art cosmic microwave background and astrophysics survey. NASA's primary participation was in enabling new technologies, specifically bolometers, radio amplifiers, and hydrogen sorption coolers. U.S. Planck scientists accounted for 20-25% of the data analysis activity; the first Planck data release was produced in the U.S. The archive is available at both ESA and NASA. There is

also participation by DOE's National Energy Research Scientific Computing Center (NERSC) laboratory on Planck and there is a DOE/NASA MOU covering this effort

The conclusion is that NASA and ESA can both fund, build, and operate major missions. Euclid is happening, as will other major missions on both sides. Research communities function largely on global entities and will push these missions towards complementarity. The U.S. has great strengths in leading-edge technologies and institutional traditions of research support by agencies and universities. Partnerships are very valuable stepping stones between US-led missions, for community and project-level planning. Good relations at a working level are crucial; critical mass of participation is important.

Jerry Blazey, Kathy Turner, Paul Hertz, and Jim Ulvestad led a discussion on access to astrophysics data, projects, and facilities in U.S. federal support for astronomy and astrophysics. The 2013 AAAC report made recommendations that *"The agencies should implement a flexible open skies policy that both affirms the ideal of open access and permits negotiation on access to federally-funded telescopes and data sets as required to establish a level of parity in access to foreign and non-federally-funded facilities and data sets,"* and *"Negotiations towards the coordination of projects or the development of partnerships should proceed on the basis of the principles of reciprocal participation and mutually agreed sharing of costs and responsibilities."*

The agencies have been working on a coordinated response to these recommendations since June. A two-page document has been developed as a starting point for AAAC consideration and discussion. The goal is for the AAAC to produce/endorse a set of mutually agreed principles that can be used as guidelines for agencies in current and future projects. These principles would be applied to all large astrophysics projects and facilities funded by NSF, NASA, and DOE. They would be applied to international collaborations, interagency collaborations, and partnerships with other public and private entities. All proposed large astrophysics projects and facilities would be assessed against these principles before a decision is made to undertake them. The five principles are: (1) Global Coordination to Optimize Use of Constrained Resources (use resources effectively, efficiently, and without unnecessary duplication); (2) Open Data (accessibility of data in a scientifically useful form; may include period of limited access); (3) Open Access (merit-based process, with opportunity for some preferred access to contributors); (4) Opportunity to Contribute (openly advertised criteria for collaboration membership); collaborations should grow in an open manner; and (5) Reciprocity (those desiring access to resources should offer similar access to their own resources).

Jerry Blazey noted that if we want the international community to follow these principles, they should first be adhered to by our own agencies. It would also be a lot easier if these were recommendations coming from the AAAC; it needs to be a document owned by the Committee. Paul Hertz noted that NASA has tried to follow these principles for all of their projects. The discussions the committee has will be informative across all disciplines within NASA. Kathy Turner noted that DOE is also looking at these principles for their projects. Jim Ulvestad noted that having these set of principles in determining whether to invest in future projects, such as the thirty-meter telescopes, would be helpful. The set of principles were set for astrophysics but could be adopted across other disciplines. These principles will cost money to the agencies.

Andy Albrecht indicated that the annual report could include endorsement of some type of document like the Principles document. Additional discussion will take place tomorrow.

MEETING ADJOURNED AT 5:00 PM EST, 13 NOVEMBER 2013
MEETING RECONVENED AT 9:00 AM EST, 14 NOVEMBER 2013

David Spergel, chair of the National Academy of Sciences Committee on Astronomy and Astrophysics (CAA), provided an update on the committee's activities since its re-activation. The goal of the CAA is to shepherd the Decadal Survey and provide strategic advice to the agencies. There are two major upcoming studies. One is a study from the NSF that grew out of a recommendation from the AAAC in its last report. This will be a look at the adjustments in priorities in the ground-based OIR system needed to address *New Worlds New Horizons* (NWNH). The CAA is in the final stages of optimizing the charge; NSF has a proposal and is reviewing it at this time. There will be a CAA session at the AAS meeting in January. The second study is the AFTA/WFIRST mission. This study will look at whether the AFTA/WFIRST mission achieves the goals of *NWNH*, including whether a potential coronagraph would achieve the exoplanets goals. The charge will be made public on the CAA web site; there will be a single meeting in January (a report in March/April timeframe).

The CAA heard discussions at their last meeting on the Gaia (Europe) mission and Japan's Space Infrared Telescope for Cosmology and Astrophysics (SPICA) mission. The CAA saw the *Nature* article the same week that Europe chose Athena as their L2 mission. These collaborations are a tremendous opportunity for the U.S. science community to advance the field. It is an opportunity to promote more coordination with international partners. As part of their charge, the CAA is looking to organize a session with international partners at the International Astronomical Union (IAU) symposium in 2015; they have proposed to the IAU to have a session focused on international collaboration, i.e., discussion of missions and mission planning (after WFIRST), data policy, etc. This may be an opportunity for the IAU to begin to have discussions on a more regular basis at their meetings on topics such as these. Paula Szkody suggested that it might be useful to have a discussion among the countries at the IAU about what they consider open access to be. Spergel is thinking about a panel discussion with the Principles document guiding those discussions.

The Committee spent additional time discussing the Principles document. Committee members are to provide their comments/edits on the document to Priscilla Cushman for an update to the preamble.

The Committee spent some time discussing the contents of the annual report that is due on March 15, 2014. Issues such as community access, open skies, data, challenges and opportunities, will be incorporated into the report.

The June 10 telecon will include an update from the agencies on their 2014 budgets and a first set of reactions to the Committee's annual report and possible implementation of the committee's recommendations.

MEETING ADJOURNED AT 12:15 PM EST, 14 NOVEMBER 2013