Minutes
High Energy Physics Advisory Panel Meeting
December 6–7, 2013
Marriott Washingtonian Hotel
Gaithersburg, Maryland

HEPAP members present:

Ursula Bassler (Friday only)
Mary Bishai
Ilan Ben-Zvi
Karen Byrum
Mirjam Cvetic
Robin Erbacher
Peter Fisher (Friday morning only)
Cecilia Gerber
Murdoch Gilchriese
Tao Han
John Hobbs
Georg Hoffstaetter
Klaus Honscheid
A. Hassan Jawahery (Friday only)
Andrew Lankford, Chair
Zoltan Ligeti
Patricia McBride
Lia Merminga
Jonathan Rosner
Thomas Shutt
Paul Steinhardt
Robert Tschirhart
Hitoshi Yamamoto

HEPAP members absent:

Leslie Rosenberg

Also participating:

Eric Colby, Program Manager, Accelerator Stewardship, Office of High Energy Physics, Office of Science, USDOE
C. Denise Caldwell, Director, Physics Division, National Science Foundation
Glen Crawford, Director, Research and Technology Division, Office of High Energy Physics, Office of Science, USDOE
Patricia Dehmer, Acting Director, Office of Science, USDOE
Jehanne Gillo, Director, Facilities and Project Management Division, Office of Nuclear Physics, USDOE
Saul Gonzalez-Martirena, Program Director, Physics Division, National Science Foundation
Paul Grannis, Department of Physics, State University of New York at Stony Brook
John Kogut, HEPAP Executive Secretary and Deputy HEPAP Designated Federal Officer, Office of High Energy Physics, Office of Science, USDOE
Robert McKeown, Deputy Director for Science, Thomas Jefferson National Accelerator Facility
Donna Nevels, Oak Ridge Institute for Science and Education
Frederick O'Hara, HEPAP Recording Secretary, Oak Ridge Institute for Science and Education
Michael Procario, Director, Facilities Division, Office of High Energy Physics, Office of Science, USDOE
Steve Ritz, Physics Department, University of California at Santa Cruz
Natalie Roe, Physics Division, Lawrence Berkeley National Laboratory
James Siegrist, Associate Director, Office of High Energy Physics, Office of Science, USDOE
David Sutter, Visiting Senior Research Scientist, University of Maryland
Vigdor Teplitz, Physicist, Goddard Space Flight Center, National Aeronautics and Space Administration
Bruce Warford, Oak Ridge Institute for Science and Education
Charles Young, Head, Elementary Particle Physics Division, SLAC National Accelerator Laboratory

About 60 others were in attendance in the course of the two-day meeting.

Friday, December 6, 2013
Morning Session

The meeting was called to order at 8:34 a.m. by the Chairman**, Andrew Lankford**. He introduced Donna Nevels to make safety and convenience announcements. Bruce Warford explained the operation of the ReadyTalk system being used to stream the meeting on the Internet and to record it.

James Siegrist was introduced to report on the activities of the Office of High Energy Physics (HEP) of the U.S. Department of Energy (DOE).

Recent results and Snowmass reports provide compelling evidence that the science focus of the HEP Program is shifting Beyond the Standard Model. The current P5 [Particle Physics Project Prioritization Panel] will elucidate a new scientific vision for HEP

Some of the boundary conditions have changed, but HEP is still trying to implement the 2008 strategic plan. The FY14 President's Request generally supports this plan, though funding constraints have led to delays in some key projects. Action on the FY14 President's Request will be key in enabling the near-term program. The Office is actively engaged with the community in developing a new strategic plan. Now is the time for input into the P5 process. Meetings are under way; the next one will be at Brookhaven National Laboratory (BNL) Dec. 15-18, 2013. Everyone is encouraged to make their voices heard and to make their teams and colleagues aware of the process. Steve Ritz will describe the modalities of input later in this meeting.

The Large Hadron Collider (LHC) has discovered something that looks very much like a Standard Model Higgs, but there is a lot more to be learned. Is it the real McCoy or an imposter? Is it alone? Why is its mass at the edge of vacuum stability? Unification of electromagnetism and the weak nuclear force is the current model for broader unification of forces. Discovery of the Higgs opens the door to more incisive studies of whether this model really works as well as it seems. We have ruled out a lot of possible candidates (e.g., supersymmetry models) with the Tevatron and initial LHC data. What will the LHC see running at 14 TeV? Detailed studies of quark and lepton "flavor" (type) changing transitions have historically taught us a lot about the structure of the Standard Model. Next-generation flavor experiments can probe well beyond the TeV scale in specific cases.

On the Energy Frontier, the discovery of the Higgs (and so far, nothing else) defines an extensive future work plan. On the Intensity Frontier, measurement of (θ_{13}) enables qualitatively new investigations of fundamental questions with neutrinos. On the Cosmic Frontier, rapid advances in Dark Matter direct detection (and the lack of direct evidence for supersymmetry) are starting to challenge models and perhaps upend the Standard Model picture. Recent progress in Advanced-Accelerator-Concept R&D is spurring ideas for future accelerator testbeds that can exploit these successes (e.g., laser-driven accelerators).

The 2013 Nobel Prize in Physics went to François Englert and Peter Higgs for their contributions to our understanding of the origin of mass, confirmed by the discovery of the Higgs boson in 2012 by the ATLAS [A Toroidal LHC ApparatuS] and CMS [Compact Muon Spectrometer] experiments at the LHC. However, the work list on the Higgs is still very long, as is that for neutrino physics. P5 will try to put these tasks in some sort of order. For example, charge-parity violation in the neutrino sector can be tested by experiment to enable an era of high-precision neutrino-oscillation measurements. The technology used to probe dark matter will be down-selected to a technique that will get beyond a shadow background. P5 will also be struggling with whether to scale up current dark-matter experiments or adopt new technology.

High-quality electron beams in a 6-GeV/m acceleration field at the new Facility for ACcelerator Experimental Test (FACET) facility demonstrate the first acceleration of a witness bunch in a beam-driven plasma wake field. This is an important step towards a meter-scale high-energy plasma based accelerator and offers a new technology with potential for far-lower accelerator size and cost.

The HEP budget philosophy is to enable new world-leading HEP capabilities in the United States through investments on all three frontiers. This strategy will be accomplished through ramp-down of existing projects and research. When this approach was not able to be fully implemented in FY14, the

planned project funds were converted to R&D. The FY14 President's Request shows increases for research that are driven by this R&D bump, while Construction/ Major Items of Equipment funding is only slightly increased. As a result, several new efforts were delayed in FY14 and are planned to recur in the FY15 President's Request. In the FY14 President's Request, the Office is attempting to maintain forward progress on new projects while minimizing the impact of research reductions to the extent possible.

HEP is currently operating under a Continuing Resolution through Jan. 15, 2014. This entails funding at FY13 levels (which are well below the FY14 President's Request and the House and Senate marks) and no new starts. The DOE Office of Science (SC) has submitted a request for anomalies to allow new project starts even in the event of another year-long continuing resolution. These issues will likely get addressed at the time of the FY14 appropriation.

As a result of this continuing resolution, new projects that were proposed for FY13/14 are struggling to get started: Large Synoptic Survey Telescope (LSST), Muon g-2, and Belle II. These will become serious issues if an appropriation is not passed by Jan 15, 2014. If the Appropriation is at ~FY13 level for HEP, there will be additional impacts to other projects. The Office was already projecting significant reductions (of order 5%) in ongoing research activities with an HEP budget at the level of the FY14 House mark in order to get new projects going.

FY13 appropriated High Energy Physics Budget was $748,314,000. The President's Request called for a total budget of $776,521, the House mark is $772,521,000, and the Senate mark is $806,590,000. It is hoped that the budget will land somewhere between the House and Senate marks. Under the current plan, the Energy Frontier would get $153,879,000, the Intensity Frontier would get $244,957,000, the Cosmic Frontier would get $95,668,000, theory and computation would get $61,533,000, Advanced Technology R&D would get $141,672,000, accelerator stewardship would get $2,944,000, Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) would get $21,177,000, and construction would get $26,466,000.

With MIE funding, NOvA [NuMI Off-Axis ν_e Appearance] is being ramped down, MicroBooNE [a detector at the Booster Neutrino Experiment] is finished, Belle II is being ramped down, the Muon g-2 Experiment is being ramped up, the High-Altitude Water Cherenkov Observatory is finished, and the large synoptic survey telescope is being ramped up. She

A Funding Opportunity Announcement (FOA) was issued on June 14, 2013. They were 134 applications submitted for review among 6 different HEP subprograms. All applications were pre-screened for compliance to the funding opportunity announcement (FOA). For the review process, experts were selected and convened during Nov. 12-22, 2013. Six panels each discussed about 25 proposals, reviewing each proposal and each senior investigator, providing additional reviews for proposal(s), and conducting a comparative evaluation of proposals and principal investigators (PIs).

Reviewer proposal assignments and input for reviews were managed through DOE's Portfolio Analysis and Management System (PAMS). The merit review process also addressed 5 criteria items:

- Scientific and/or technical merit of the project
- Appropriateness of the proposed method or approach
- Competency of the research team and adequacy of available resources
- Reasonableness and appropriateness of the proposed budget
- Relevance to the mission of the HEP program

The DOE HEP post-panel review is currently assessing the reviews on each proposal and each senior investigator to develop guidance and funding levels. By mid-January 2014, PIs will be given guidance and funding levels with a request to submit revised budgets and justifications. The proposal procurement packages will be routed through DOE/SC and the DOE Chicago Operations Office. Funded grants are to begin their first year on or about May 1, 2014.

Beginning in FY14, DOE/SC will transition to full funding of multi-year grants and/or cooperative agreements received from academic institutions with a total cost of less than $1 million. "Full funding" implies funds for the entire award for the project period is obligated at the time the award is made, instead

of funding year-by-year. The process for full funding applies to new, renewal, or supplemental grant awards that are made after the merit review process. A transition is planned over the course of five years. Grants and cooperative agreements with a total cost of $1 million or more are exempt from the transition. There will be no change to how an applicant applies for a grant or cooperative agreement. There will be no change to the merit review process. There will be no change to DOE program managers' (PMs) requesting revised budgets from PIs.

DOE PMs will continue to have oversight of the research program by requiring PIs to submit an annual research performance progress report that must be approved by the PM prior to any funds being accessed by the PI the following year. All SC program offices, including HEP, will aim to carry out the transition in a way that minimizes impacts on the scientific community and the mission needs served by the Office.

Fisher asked if Siegrist could say more about g-2. Siegrist replied that the Office hoped that permission for a start would be forthcoming soon. Fisher asked if there would be a downselect. Siegrist replied, yes. Shutt asked if funding might go down. Siegrist answered that recommendations would be obtained from P5.

Byrum asked what the motivation was for multiyear funding. Siegrist replied, to keep Congress as happy as possible. Congress wants to control allocations, but forward funding is needed. Lankford asked if this commits FY15–16 funds. Siegrist replied, yes. Crawford added that about half of the proposals to the current FOA fall into this category of funding. After 3 years, all of the projects in this category should be transitioned.

Lankford asked what the criterion was for an anomaly. Siegrist answered that a lot of groveling is done. DOE needs to cooperate with the National Science Foundation (NSF) and make the strongest case for as many projects as possible. Procario noted that anomaly status was requested for all projects possible. They were not obtained under last year's continuing resolution. Bishai asked where this decision got made. Siegrist answered that the budgets are too uncertain to be able to say.

C. Denise Caldwell was introduced to describe the activities of the divisions of Physics and Astronomical Sciences of the National Science Foundation (NSF).

At NSF, budgets are set by the Director of NSF, who works closely with the Office of Management and Budget (OMB) and Congress. Funds are then allocated to directorates then to divisions and then to programs. Currently (FY13), there are six lines in the NSF Budget. P5 has an interest in

- Research and Related Activities (R&RA, $5,544 million), which grants research awards in *all* research directorates; Facilities and Operations are included here. The operations of the Physics Division (PHY) are no more than one-third of the total budget. Astronomy operations are more than 50% of the budget.
- Major Research Equipment and Facilities Construction (MREFC, $196M), which includes no funds for operations; funds disappear when construction is complete.

The Director has flexibility in making program and Directorate allocations but also has constraints; however, the President's budget has detailed bottoms-up justifications administration priorities that can siphon funds away from research projects. Appropriations language can highlight Congressional priorities. Budget cuts can impact core research programs (9.6% of the PHY budget was cut in FY13).

The NSF mission is broad; all disciplines compete every year for non-core funding (presidential priorities). Planning for long-term projects is difficult, although essential for high-energy physics.

Under the current budget constraints, a lot of very good science will not be funded.

Funded projects should reflect the strongest case for scientific progress at the frontier of knowledge. They should also have the potential to transform society either directly or indirectly and should offer a reasonable expectation of affordability over the long term.

The Physics Division tries to maximize the impact of NSF funds by investing in a few high-impact mid-scale projects or contributing to large efforts with incremental impact while optimizing the use of resources that are otherwise funded. The focus is on the science questions while pursuing cross-cutting programs, where feasible, and encouraging connections across PHY sub-areas (e.g., Major Research Instrumentation and Computational and Data-Enabled Science and Engineering).

High-energy physics has been and should remain highly competitive at NSF.

The Physics Division Particle Physics Funding covers research, LHC operations, the Cornell Electron Storage Ring, and accelerators and instrumentation. Funding in this area declined from about $55 million to $44 million from FY12 to FY13. Funding for theory at the physics centers remained flat at $6 million. All of this accounts for about one-third of the Division's funding.

The LSST is a Stage-IV Dark Energy experiment, with many other astrophysical goals. The FY14 President's Request seeks an MREFC budget for this project. The dark-energy efforts of the Directorate for Mathematical and Physical Sciences (MSP) have contributed to the funding of Sloan Digital Sky Survey (SDSS) over the years. Together with university and private sources, it is funding the Hobby Eberley Telescope Dark Energy Experiment (HETDEX), another Stage-III spectroscopic experiment at higher redshift. It is supporting the Dark Energy Survey (DES), a Stage-III imaging experiment on the Blanco 4-m telescope in Chile. DOE/HEP has selected the NSF Mayall 4-m telescope in Arizona as the host for the Dark Energy Spectroscopic Instrument (DESI), with Lawrence Berkeley National Laboratory (LBNL) as the lead institution. The further advance of DESI depends strongly on the report and recommendations of the P5 committee.

NSF considers the P5 process as critical because NSF funds are limited and particle physics must compete with all the other sciences.

NSF appreciates P5's charge to focus on the science. It also looks for maximum impact. The science payoff must justify the level of investment, and P5 is charged to describe the scientific return on investments.

To NSF, the primary impact beyond the science is the training of students.

About 20% of NSF and Division funding opportunities are related to particle physics. These are NOT particle-physics programs. Any proposal must be competitive with science in other areas, the project must enable a major advance in the science, and costs must mesh well with other support for the project (e.g., operating costs).

NSF has just opened an Accelerator Science program. The response is very healthy.

Bishai asked if there were statistics on where the funded graduate students end up. Caldwell replied that the American Physical Society (APS) has issued a report on graduate students and where they go. NSF cannot track students because of privacy issues.

Erbacher noted that Caldwell had mentioned the tension between construction and operations budget lines and asked if NSF was always constrained to operating within a set budget so that it has to take money out of one line to add it to another. Caldwell said that one has to plan ahead to provide for operation costs when construction is planned. When construction is finished, that budget amount disappears. Separate funding for operations has to be planned for. Funding for major research equipment and facilities construction and operations has to be developed simultaneously.

Tschirhart asked if the NSF is broadly responsible for promoting basic science. Caldwell replied, yes; the NSF is responsive through several investment paths (e.g., accelerator science). At the top NSF level, there will be support for this. The allocation process then occurs within the divisions. One has to make a case for basic research; in the end, this is what pays off. The quest for knowledge and human progress is a fundamental human characteristic. One has to do it. The LHC is an incredible social experiment with hundreds of thousands of people working together. If you have a quest, it will drive the advance. The payoff will probably be something you never expected. It is amazing how many researchers in biology have PhD's in physics.

Bishai asked how impact was assessed. Caldwell replied, through the review process.

A break was declared at 9:52 a.m.

The meeting was called back into session at 10:29 a.m., and **Michael Procario** was asked to review the background of the HEP Committee of Visitors (COV) review.

The HEP Program's mission is to understand how the universe works at its most fundamental level, which is done by discovering the elementary constituents of matter and energy, probing the interactions between them, and exploring the basic nature of space and time. The Office supports innovative scientific research that advances our knowledge; builds and operates the forefront scientific facilities needed to do

the research; and acts as a steward of human resources, essential scientific/technology disciplines, institutions, and scientific user facilities.

It executes that vision through strategic planning, getting input through HEPAP reports, Astronomy and Astrophysics Advisory Committee reports, National Research Council (NRC) reports, community workshops and studies, facility and institution reviews, laboratory managers' budget briefings, office retreats, OMB, DOE, and congressional guidance. Funding decisions are based on appropriated budgets, internal budget plans, international and interagency commitments, facility and institution reviews, program reviews and briefings, laboratory managers' budget briefings, laboratory field work proposals, and university and other proposals. The Office issues an initial financial plan, monthly financial plans, and financial assistance awards.

In 2010 on the Energy Frontier, the LHC research program was delayed and there was a new plan for LHC, and the Tevatron performance continued to be outstanding. On the Intensity Frontier, significant progress was being made on the implementation of a U.S. leadership program, and a model was established for a joint-agency Deep Underground Science and Engineering Laboratory (DUSEL) physics program. On the Cosmic Frontier, the Particle Astrophysics Scientific Assessment Group (PASAG) and Astro2010 reports have been published, and the Office of Science and Technology Policy worked for a coordinated agency response. In the technology sector, there was a delay in the LHC schedule related to a delayed decision on the next lepton collider, and the Accelerator R&D Workshop Report provided guidance on priorities.

For the past decade, funding for the Office has been below that projected in P5's Scenario A.

Today, on the Energy Frontier, the LHC research program has turned around, CERN has revised its midterm plan, and the Phase I upgrades have started. On the Intensity Frontier, there has been significant progress, although not all of the path that was planned. NOvA will begin running in 2014. Belle II, g-2, and the Muon-to-Electron Conversion Experiment (Mu2e) will follow. Multiple R&D efforts are being coordinated in the neutrino sector leading to LBNE. On the Cosmic Frontier, the Office is implanting the guidance received as best as it can. The Dark Energy Survey is operating. Second-generation dark matter is to follow. In the technology sector, the U.S. International Linear Collider (ILC) Team completed the Technical Design Report, FACET and BELLA [BErkeley Lab Laser Accelerator] were built and are operating, and the Accelerator Stewardship Plan has been put together.

Currently, the program fraction for research is about 50% of the budget, that for facilities is about 33%, and that for projects is about 17%; P5 had called for an increase in the program fraction for projects.

The Strategic Plan sent to Congress in October 2012 incorporated eight requests for an accelerator stewardship subprogram, an SC program that is managed/coordinated by HEP. This is not yet an approved program. Its strategy is to improve access to national laboratory accelerator facilities and resources for industrial and for other U.S. government agency users and developers of accelerators and related technology; to work with the accelerator user communities and industrial accelerator providers to develop innovative solutions to critical problems, to the mutual benefit of our customers and the DOE discovery science community; and to serve as a catalyst to broaden and strengthen the community of accelerator users and providers .

The SBIR and STTR are congressionally mandated programs. A fraction of HEP's operating budget goes to these programs; that fraction has been increasing at the direction of Congress. HEP provides technical expertise to review and evaluate proposals. It does not set the rules for this program. Funding for HEP proposals exceeds the amount "taxed" from the HEP program.

Early Career is an SC-wide program. HEP manages the review and selection of HEP proposals according to SC guidance. The program is very competitive (~10% success rate). HEP Early Career proposals were made available for the COV review.

Program managers are responsible and accountable for specific subprograms and/or projects. They used to align management responsibilities with the budget.

The management model changed to a frontier basis in 2010, and the budget substructure was modified to allow tracking in this basis starting in FY10. The HEP budget structure was modified to the

frontiers basis effective with FY13 budget execution with the approval of DOE's Chief Financial Officer, OMB, and Congress.

In the Office, program managers are the professional staff; budget managers manage the portfolio and its associated budget, coordinate reviews, and make funding recommendations; project managers oversee projects and associated budgets; grant monitors are the point of contact for a given HEP University Grant; and laboratory monitors are the point of contact for a given national-laboratory program.

HEP uses a series of budget categories, and budget managers are given control totals that they have to hit. The associate director has a reserve to solve problems.

For DOE as a whole, only about 10% of the total funding goes to grants as compared to contracts. The financial infrastructure reflects this distribution and is not optimized for grants. However, grants are a large fraction of the total number of actions. Grant awards are a multistep process, and multiple people and software products are involved. Therefore, considerable lead time is built-in for grants review, action, and processing. Much of this process is becoming more automated with modern software. This system is currently a mixed process with both hardcopy and electronic files.

The grant review process has changed. The old system (FY10-11) was based on mail-in reviews (occasionally on-site panels). Nearly every group was ranked at least "good." It was hard to compare reviews and make decisions. Comparative Review started in FY12 after several months of preparation. The goal of this effort is to improve the overall quality and efficacy of the HEP research program by identifying the best proposals. This change in process was recommended by several DOE advisory committees, including the 2010 HEP COV.

HEP implemented a new review process for national labs in 2008. There is a Fermilab Science and Technology (S&T) Review annually. There are laboratory research group reviews (on a rotating basis) on non-accelerator (Cosmic) and electron-based (Intensity) subprograms, theory, Energy Frontier and detector R&D subprograms, and accelerator science, Cosmic Frontier, Intensity Frontier subprograms. Institutional reviews are done on a rotating basis. Outcomes from reviews are incorporated into funding decisions.

HEP has undertaken the first round of comparative reviews. The data for the FY12 Comparative Review by proposal are: 136 proposals were received, 14 were declined or withdrawn, 122 were reviewed, and 85 were funded, for a success rate of 70%. This is a new process, but it ran relatively smoothly. The goal is a better optimized, more efficient program. A large number of new PIs applied, and about half are being supported. Existing PIs mostly reviewed well, but there is some turnover.

The total number of PIs is about constant but several new junior faculty members were supported, some senior faculty members are no longer supported, and several senior research faculty members are no longer supported. It is expected that the total full-time equivalents (FTEs) supported will be down somewhat. The FY14 comparative reviews were held in November.

In FY12, HEP funded 1785 FTEs through 225 grants at 109 universities. In research, there were 185 FTEs in Energy, 115 in Intensity, 125 and Cosmic, 120 in theory/occupation, 250 and Advanced Technology, and 1520 in project and facility operations for a grand total of 4080 FTEs. There was a large spike in new proposals in FY12 as well as a significant increase in new awards.

The facility division's responsibilities cover user facilities and large operations programs (the Fermilab Accelerator Complex, LHC Operations Program, and FACET). Small operations programs managed out of the Research Division. HEP-directed accelerator R&D includes the LHC Accelerator Research Program (LARP) and Muon Accelerator Program (MAP), which have management structures more like projects with real deliverables and milestones. They will largely be covered by the Accelerator Subcommittee.

In user facilities, the B-factory was shut down in FY08, and the Tevatron at the end of FY11. HEP currently supports two official user facilities: the Fermilab Accelerator Complex and FACET. There are three efforts that we are considering naming user facilities: the CMS Center at Fermilab (which has the LHC Physics Center; Remote Control Room; Tier 1 Center and Calibration and Alignment Facility); the ATLAS Center (which is currently less well defined); and the Accelerator Test Facility at BNL (which

has functioned as a true user facility for decades). A standard definition of a user facility is being developed.

The goal for user facilities and other operations programs is to support research effectively and efficiently. Metrics vary depending on the program: for the Tevatron and B-factory, maximize integrated luminosity; for neutrino beams, protons on target; for LHC operations, computer uptime, jobs run, detector uptime, and minimal deadtime; and for the FACET Accelerator Test Facility, the number of users and the time needed to collect data. The metrics are then correlated with the science produced to see if high-impact results are coming out of the facilities. The Tevatron met all its integrated-luminosity targets, the Fermi accelerator up time met or exceeded all of its targets, the NuMi met or exceeded all its protons-on-target targets, and the cost-weighted cost performance index and schedule performance index met all of their targets.

The Fermilab Science and Technology Review is held annually to assess accelerator performance, judge the quality of the science, and conduct planning for the future. Dedicated operations reviews have been held in the past.

The LHC Operations Review is conducted jointly with NSF each year to look at Tier 1 and Tier 2 computing-center performance. It evaluates detector maintenance and operations performance and reviews the impact of the program on researchers.

The ILC, LARP, and MAP reviews are conducted every 12 to 18 months. The last ILC review was held in FY10.

The HEP project-management strategy is aligned with the SC project-management strategy. The management goals are to develop high-quality cost estimates and then to build to cost and to develop realistic funding profiles and stick to them. The Office is still trying to increase the front loading of the funding; it is being successful at maintaining profiles that it establishes. Another management goal is to hold the contractor accountable for management of the project. Problems should be identified and solutions be proposed by the contractor. The Office looks for strong indications at multiple levels so no surprises occur.

The Integrated Project Team meets every 1 to 2 weeks, typically by teleconference, to coordinate laboratory oversight and program office oversight.

From FY10 to FY12, the Project Portfolio has seen for projects successfully completed: BELLA, FACET, Daya Bay, and DES. The Accelerator Project for the Upgrade of the LHC is all but done, MicroBooNE has a delayed CD-4 [Critical Decision-4], and NOvA is rapidly coming to an end. CD-1s have been completed for Belle II, the Long-Baseline Neutrino Experiment (LBNE), LSST, and Mu2e. CD-0s are under development for Muon g-2, the LHC ATLAS upgrade, the LHC CMS upgrade, the Dark Matter Gen-2, and the Dark Energy Spectroscopic Survey.

Independent project reviews are constructive assessments of performance, readiness, strength, and robustness of a project management organization at all levels for each Critical Decision and 1 to 2 times per year, depending on size, and a full-scope review or targeted mini-review, depending on the issues. The program office writes a situation-specific charge for the review, the Office of Project Assessment organizes the review committee, a pre-review is conducted by the lead laboratory, the review committee meets with the project at the laboratory, and follow-up is conducted (a two-page summary, a final report, and timely response).

Bishai stated that the accelerator stewardship program is confusing and asked if it will replace any existing project. Procario replied that some projects are expected to migrate over to accelerator stewardship but not a lot. A lot of new funding is expected for FOA proposals. Bishai asked if non-HEP funds would be involved. Procario answered, yes, but there is not a lot of funding of accelerator R&D being done elsewhere.

Bishai stated that some institutions are getting reviewed quite a bit and asked if any statistics were available on the number of hours spent on reviews. Procario replied, no; an effort is made to limit reviews to the number needed. Director reviews and laboratory reviews require a lot of time and are coordinated with the NSF. Research projects also get reviewed by their institutions. It is a problem that needs to be addressed.

Tschirhart noted that the Proton Improvement Plan is going to be on HEP's books. Procario responded that the Office will ensure that it is properly set up. Tschirhart asked what the motivation was for setting standard criteria for use of facilities. Procario said that the Office wants to be able to say how many people are being supported in this research by these laboratories.

A break for lunch was declared at 11:16 a.m.

Friday, December 6, 2013
Afternoon Session

The meeting was called back into session at 12:48 p.m., and **Andrew Lankford** called attention to the celebration of the discovery of the Higgs boson and other recent advances in particle physics, which celebration was sponsored by Universities Research Association, the American Physical Society, and the Division of Particles and Fields at the House Science and National Laboratories Caucus at the Rayburn Building on November 20, 2013.

The event was very successful. It was modeled on the LSST Goes to Capitol Hill in 2012 and 2013. The event consisted of congressional visits during the day by universities and national laboratories and an evening reception with short speeches and a science talk. Between 250 and 300 people attended, about half of whom were not from the particle physics community. Six congressmen spoke enthusiastically about particle physics and science in general, and as many as ten were reported to be in attendance. Multiple follow-up phone calls were received from Congressional offices interested in talking about the event, getting more information, giving congratulations, or simply thanking us for the hard work that has been done.

Lankford also announced the retirement of Daniel Lehman, which will be a loss to the field because of the sageness of his advice and insights. Lehman, who was present, received a round of applause.

Patricia Dehmer was introduced to review the status and activities of SC.

Lynn Orr, associate professor and professor in Stanford's Department of Energy Resources Engineering, has been nominated to be the next Director of the Office of Basic Energy Sciences (BES). Marc Kastner, dean of the School of Science at the Massachusetts Institute of Technology, has been nominated to be the next Director of SC.

SC touches more people through its user facilities (29,000 users each year) than it does through direct funding. It has supported research that has led to more than 100 Nobel Prizes during the past six decades, and it is currently supporting 25,000 Ph.D. scientists, graduate students, undergraduates, engineers, and support staff at more than 300 institutions. User facilities address needs of the scientific community not met by other government agencies, public organizations, private entities, or international bodies.

Of the users at the approximately 30 SC facilities, nearly three-fourths of them do their work at Advanced Scientific Computing Research (ASCR) or BES facilities. About 1700 (or 6%) use HEP facilities. For the past 30 years, each new light source has attracted new users, often from out of the field (e.g., biology). The past four Nobel prizes in medicine/biology went to SC facility users.

A list of new facilities and terminated facilities shows that, as older facilities are shut down, newer facilities are opened up. A chart of total SC funding from FY 98 to FY14 shows a gradual increase over the years with a noticeable peak in FY09 when the full SC budget was appropriated by Congress during the first year of the Obama administration and a noticeable dip in FY13 that resulted from the sequester. A chart of major SC program funding, expressed as a percent of total research in SC, shows that Nuclear Physics has been flat, HEP has decreased about 16%, Fusion Energy Sciences has been flat, Biological and Environmental Research (BER) has decreased, and BES and ASCR have exhibited the largest research-budget growths.

When he was the director of SC, Ray Orbach compiled the report, *Facilities for the Future of Science: A 20-Year Outlook*, in 2003. We are now at the half-way point of that projection. Funding envelopes were constructed from the "Biggert Bill" authorization levels for SC for FY04 through FY08 replaced later by H.R. 6 and S. 14) and then a four percent increase in authorization level each following year until 2023. H.R. 34, the Energy and Science Research Investment Act of 2003, aka the Biggert Bill,

authorized an increase in funding for SC of ~60% from FY 2004 through FY 2007. The bill called for an increase of ~8% for FY 2004 followed by increases of 11%, 15%, and 15% in the following three years. The FY 2007 authorization level would have been $5.31 billion. The Office is at $4.6 billion now, so the big envelope did not develop. Orbach considered about 50 facility proposals, selected 30 of them, and ranked them.

- The International Thermonuclear Experimental Reactor (ITER) is under way
- The Argonne National Laboratory and Oak Ridge National Laboratory Leadership Computing Facilities (LCFs) are complete and have already been upgraded
- The Joint Dark Energy Mission was terminated
- The Linac Coherent Light Source has been completed and is awaiting Congressional approval for upgrade
- The Protein Production and Tags was replaced with the Bioenergy Research Centers (BRCs), which are not user facilities
- The Rare Isotope Accelerator was replaced with the less expensive Facility for Rare Isotope Beams, which is awaiting Congressional start
- The Characterization and Imaging Facility was replaced with the BRCs, which are not user facilities
- The Continuous Electron Beam Accelerator Facility upgrade is in progress
- The Esnet upgrade is complete
- The National Energy Research Scientific Computing Center upgrade is complete
- The Transmission Electron Aberration Telescope is complete
- B Physics at the Tevatron was terminated
- The Linear Collider was terminated
- Analysis and Modeling of Cellular Systems was replaced with the BRCs, which are not user facilities
- The Spallation Neutron Source (SNS) power upgrade was deferred and will be included in the second target station
- The SNS second target station has passed CD-0, but its cost precludes a near-term start
- Whole Genome Analysis was replaced with the BRCs, which are not user facilities
- Double-Beta Decay Underground Sector was funded partially; the Majorana Demonstrator is operating in South Dakota, but is not yet fully operational
- The Next-Step Spherical Tokamak was terminated because of cost overruns; an upgrade of the National Spherical Torus Experiment was pursued instead
- The RHIC II [Relativistic Heavy Ion Collider] luminosity upgrade was completed at a fraction of the cost and at 10% of the operating budget
- The National Synchrotron Light Source upgrade will be commissioned in FY14; it is the only facility to rise in the list of priorities
- The Super Neutrino Beam has been partially funded; NOvA is nearly complete, but the LBNE is unfunded
- The Advanced Light Source upgrade did not go forward
- The Advanced Photon Source upgrade was funded partially; it has R&D funding
- The Electron Relativistic Heavy Ion Collider did not go forward
- The Fusion Energy Contingency Facility did not go forward
- The High-Flux Isotope Reactor second cold source and guide hall did not go forward
- The Integrated Beam Experiment did not go forward

Orbach's legacy is the great success of the leadership computing facilities. Instead of a number of stand-alone research centers, BER got the BRCs. Other proposals got funding if they were moderately priced.

At this point in time, Congress wants a new study to prioritize addition of scientific facilities to ensure optimal benefit from federal investments. It has asked the agencies by September 30, 2013, to formulate a 10-year prioritization of scientific facilities across the Office of Science based on (1) the ability of the facility to contribute to world-leading science, (2) the readiness of the facility for construction, and (3) an estimated construction and operations cost of the facility.

SC provided funding levels to the SC Associate Directors (ADs) with modest-growth funding scenarios. The ADs prepared draft lists of facilities. Lists were submitted to the respective Federal Advisory Committees. There being no political appointee in SC leadership, the facilities were grouped in bins, but they were not numerically ranked. The bins were those facilities already under way, those in the FY15 budget request, those that are important to stand up in the next 10 years, those under review, those unlikely to proceed, and those that were rejected. This information was passed on to the OMB. This exercise made obvious what program managers are needing to plan for, and one program stood out: the LHC. In two to four weeks, OMB and Congress were being briefed.

There was discomfort with the growth in the number of light sources in the projects; it was unsustainable. Therefore, the director of SC issued a charge to the Basic Energy Sciences Advisory Committee (BESAC) to develop

- An assessment of the grand science challenges
- An evaluation of the effectiveness of the present SC light source portfolio
- An enumeration of future light source performance specifications
- Prioritized recommendations
- Identification of prioritized R&D initiatives

The final report was accepted by BESAC on July 25, 2013. The major findings were that

- international activity in the construction of new diffraction-limited storage rings and new free-electron-laser facilities will seriously challenge U.S. leadership in the decades to come
- The United States will no longer hold a leadership role in such facilities unless new unique facilities are developed

The major recommendations were that

- These new free-electron lasers should provide high-repetition-rate, ultra-bright, transform-limited, femtosecond x-ray pulses over a broad photon energy range with full spatial and temporal coherence. Stability and precision timing will be critical characteristics of the new light source.
- These new storage rings will require a careful evaluation of present upgrade plans to determine paths forward that will guarantee that U.S. facilities remain at the cutting edge of x-ray storage ring science.

Current plans obviously would not meet these ends. New facilities are needed.

A meeting was held with all three laboratory directors to see how the current facilities could be upgraded and to ask what they would propose. SLAC proposed to add a superconducting linac in the existing tunnel and two new undulators to produce the world leading high-repetition-rate free-electron laser in the 0.2- to 5-keV photon energy range. No civil construction is required. The LCLS [Linac Coherent Light Source] Ultrafast Science Instruments II (LUSI-II) is not required in the modified LCLS-II proposal. ANL proposed a multi-bend achromat lattice in the existing tunnel; a doubling of the ring current; new insertion devices and beamlines to boost ring brightness. LBNL terminated the Next-generation Light Source project because it could not be upgraded at a competitive cost. The SLAC and APS upgrades will go forward in the next 10 years. This is very different from what had previously been envisioned for the light sources in SC for the next 20 years.

The moral of this story for the HEP program, given the Secretary's significant concern about the future HEP Strategic Plan and the initial funding requirements for these very big upgrades and the LBNE, is that the Secretary recognizes that the cost of the LBNE as it is now does not cover the full cost of the LBNE that the scientific community wants. Recognizing this mismatch, HEPAP has a very significant challenge as it considers what its Strategic Plan and the funding envelope are going to look like. The

charge to HEPAP cites three funding scenarios: The first is at the FY13 level, which is then flat for 3 years and then increasing at 2% per year. That scenario is not unreasonable. The second scenario is flat at the FY14 President's Request and then increasing at 3% per year. That is optimistic. The third scenario is unconstrained. One does not have to spend a lot of time on this version unless one just wants to list all of the options.

Tschirhart said that setting the fraction of the budget that should be in projects has been growing, with a goal of 25%; he asked if that was too optimistic. Dehmer replied that BES likes to put 40% in research, 40% in facility operations, and 20% in construction. That is not unreasonable. NP is a poster child right now because its budget is skewed toward operations and construction. That worries people who look at the fractions.

Bishai asked how the Office responded to people who say that they would not care if the U.S. leadership in high-energy physics were lost. Dehmer replied that, in DOE, some facilities and disciplines have priorities because of their broad impact in science, engineering, industry, national security, or economic development, and that will get priority. She had never heard anyone say they did not care about high-energy physics. However, one has to decide where the United States should be in the leadership of a particular discipline. The United States cannot be a leader in everything.

Han said that, given the major discovery, people have talked about establishing a Higgs factory. He asked what the chances were that the United States would be involved. Because the R&D would take so long, shouldn't the U.S. community be more engaged? Dehmer replied that, because of the scale, it is not too probable now. Han asked if it would be feasible if the community proposed a domestic accelerator. Dehmer responded that she did not see a problem with it. If one only wants a large facility on one's own soil, that is not a good strategy. One needs to be highly tactical and place the proposal in a context of a larger portfolio.

Bishai asked if the Secretary had been shown the profile of percentage of funding in SC. Dehmer answered that he knows about it. Bishai asked whether, given the competition with new sciences, he considered enlarging the overall SC envelope. Dehmer replied that most people in Washington would say that it is not a viable option. If he were to push for increases in the Department, it would be for a specific program. When the budget is submitted to OMB, an accompanying letter states the priorities. Overall increases are not likely to happen.

McBride observed that the United States often does not get credit for user participation. Also, it needs to be a better international partner. The United States needs to be welcoming. Dehmer replied that HEP is working very hard on that. The Secretary is very interested in international collaboration and in what an memorandum of agreement should look like. More international collaboration is needed. McBride stated that high-energy physics is often at the forefront of high-performance computing but it does not always fit into the budgeting trends of the field.

Jawahery said that the trend is that the budget profile for HEP is shrinking and funding for facilities is declining as facilities that are shut down are not replaced. That is not because of the excitement of the science. One would worry that (1) the United States would not have facilities and (2) the U.S. high-energy-physics community might lose the fraction of research money that goes into the field. He asked if the community should be worried about the fact that, because it is losing facilities, it will lose the commitment to research. Siegrest replied that he did not have a good answer to that. It is a subject that warrants more discussion Dehmer said that striking the balance is done every year. Siegrist added that the Office has to have a good picture of what is happening. Dehmer stated that, tactically, the best way to go is to have construction already occurring and then strike a deal.

Gerber said that, if the leadership argument was not effective, what would be the most effective way of putting something forward. Dehmer replied that she would not use the training of students as an argument; that falls on deaf ears. Rather, she would make the argument on the basis of basic discovery science and its impacts; *and* one should set a level of leadership that the United States should attain. There *are* broader impacts, but that should not be the lead argument.

Bishai asked how one can balance the funding of high- and low-impact science. Dehmer responded that that is the question that the Office is asking you as an advisory committee.

Tschirhart said that the Panel had heard that high-energy physics can play a role in accelerator stewardship, but the concept has not been approved. Dehmer replied that such funding had been proposed, and the Department was awaiting pushback from OMB. She was optimistic that it will be approved.

Erbacher asked whether, when the numbers are given to OMB, they have the authority to prioritize them. Dehmer said that they will not do that. If the Department proposes a hefty upgrade of a project, OMB wants to know why. Erbacher asked how this administration and secretary regard science. Dehmer said that, if one looks at the FY14 President's Request, science funding is significantly higher than that for FY13. However, there is the concern that the Department cannot hold on to that increase during congressional actions. Even that increase does not do everything it needs to do. Erbacher noted that Dehmer had said that the community needs to come up with a big project to promote. Dehmer said, no. What she had said was that the community needs a strategy and tactical plan that it can support. Without a community-backed plan, you will not succeed.

Steinhardt noted that ATP is competing with others on different time scales. Other researchers often have incremental discoveries. He asked how to impress on people that they have to wait for results to occur. Dehmer stated that, if one bases one's arguments on solid logic, one does not have to worry about the rapidity of results. There are times when facilities are ripe for rapid discoveries. That is not the case now. Her observation was that the administration and congressional staff are sympathetic to the field. Communities of interest are important to SC.

Natalie Roe asked whether leadership in high-energy physics was important and realistic. Dehmer answered that one cannot be a leader in every discipline. One has to make choices. One needs to make the arguments (e.g., through P5). One has to ask, what is the argument that is going to be made? Communities have to be very sophisticated in how they talk about themselves. Their words go far beyond the immediate community.

Paul Grannis was asked to present the report on the COV of HEP.

The COV was charged by the Office of Science with assessing (1) the efficacy and quality of the processes used to solicit, review, recommend, monitor, and document application, proposal, and award actions and (2) the quality of the resulting portfolio, including its breadth and depth and its national and international standing. It also was to assess the implementation of changes recommended by the 2010 COV, P5, and other recent HEPAP panels:

- Use comparative reviews (in addition to individual mail-in reviews)
- Increase the HEP budget fraction for projects (at the expense of research)
- Formulate a strategic plan for accelerator stewardship in DOE
- Improve the database of program information

The COV was also charged to evaluate: How has the re-organized research program (into Energy, Intensity, and Cosmic Frontiers worked? Are proposals that cross boundaries adequately reviewed? Is the program well balanced?

The COV met in Germantown on Oct. 9-11, 2013, with presentations from HEP; several breakout sessions for the seven subcommittees to view materials, discuss findings and formulate recommendations; and several full-committee executive sessions to discuss recommendations and highlight those that cut across subcommittees.

The overall conclusion is that HEP is carrying out its mission with integrity, efficiency and a keen awareness of the trends in the field. The COV also made a series of other findings:

The new classification based on physics thrusts is important in communicating the field within the government. There are, however, many overlaps in the physics and techniques among the frontiers. While an organizing principle is needed, it is necessary to keep the coherence of the program in mind and to protect against stovepiping. The ability to move funds flexibly from one frontier to another, when need arises, should be retained. HEP might consider rotating program managers from one frontier to another at ~5 year intervals to promote broad stewardship and awareness of the full program.

The comparative reviews adopted in 2012 are an improvement over the previous mail-in-reviews-only process. The outcomes were fair. The panel sizes and choice of reviewers were in most cases

appropriate. The mail-in reviews add important information or independent expertise to the comparative review process. The alignment of review panels along the frontier boundaries is natural, but the Committee worries that this subdivision could lead to a more parochial view of the program than is desirable. HEP should continue to assess the optimum way to achieve balance. The comparative reviews would be enhanced if the relevant materials were provided to the panels before the review, and if questions of factual clarification from the panel to proponents could be made before or during the review.

In proposals addressing multiple frontiers, it is important to consider all aspects of the full proposal. For PIs transitioning between frontiers it is important to assess their prior track record. Often the physics questions and techniques in one frontier bear directly on work in other frontiers. It would be useful to recognize this connectivity by including reviewers from other frontiers and asking reviewers to specifically comment on the synergies in such cross-frontier proposals.

The current comparative reviews should provide the HEP program managers with sufficient information to synthesize evaluations and rankings that reflect the collective assessments of the panel members. Program managers' comments in the folder on the reasons for the action taken were often terse, or absent. Program managers should assure that inappropriate comments are removed from the reports.

Reducing or delaying grant funding because of the existence of alternate sources of support, such as university startups or other non-DOE sources, is counterproductive, as it penalizes those who have demonstrated substantial initiative and promise.

If a PI's funding is discontinued, his/her postdocs/students should be protected.

The time between proposal and notification has moved in the right direction; but in some cases, administrative delays within HEP contributed substantially to delay.

The impact of realignment of grant start dates has affected all university programs. After realignment is completed in FY15, the resources liberated might be used to ameliorate the negative effects incurred during the previous three years.

This COV did not make a substantial review of laboratory comparative reviews. A more detailed evaluation of the laboratory research reviews should be made by the next COV, including comparison with university comparative reviews.

The fraction of the HEP budget devoted to projects dipped to ~5% in FY07, down from prior levels of ~20%. The 2010 COV recommended an increase. By FY12, after the American Recovery and Reinvestment Act of 2009, the project fraction had increased to about 17%.

The continuity and expertise of senior scientists have been major factors in the success of many large projects. It is important to have information in the proposal that allows evaluation of senior research scientists. A criterion used by some reviewers for termination was whether a good postdoc could perform the tasks. The COV felt that this criterion is ill-advised.

Sub-project level experiments (less than $5 million) often introduce innovative techniques or attack novel physics questions and should be allowed a higher degree of risk. Formal project management for these experiments can give an unwarranted burden.

Detector R&D, like accelerator R&D, seeds new advances for the field. Directed R&D funding for specific approved experiments should be attributed to that experiment. However, R&D that develops new techniques or capabilities, whether motivated by finding new methods for potential future initiatives or purely generic, forms a continuum and should be treated uniformly because both bring wider benefits to the program. The motivation for detector R&D is shared by other SC programs and cooperative approaches could usefully be pursued.

The 2010 COV recommended an increase in HEP staff. The program management staff increased from 13 Feds [plus four Intergovernmental Personnel Act detailees (IPAs)] in 2010 to 15 (plus nine IPAs) in 2013. Administrative staff levels declined somewhat. The ratio of program managers to budget dollars is similar for HEP and other SC Divisions. The Theory program handles ~85 grants but is managed by just one person.

Travel budgets have been reduced since the last COV review. Travel budgets are set at the level of the Office of Science. Visits to project sites enhance the evaluation of progress and problems, the quality of project infrastructure, and discussions with project managers. The large off-shore research in international

collaborations that rather uniquely characterize HEP requires special HEP travel to negotiate the terms of U.S. participation, monitor international cooperative agreements, attend oversight Council meetings, and evaluate the U.S. performance in these projects, thus diminishing the budget for domestic program oversight.

The COV noted the damaging aspect of the current travel rules for Lab-supported personnel that restrict their ability to travel to meetings to present recent work and interact with the broader community. Conferences and workshops are essential in a globally connected field like HEP. The rules also have inhibited laboratory hosting of conferences. The restrictions on travel can damage the competitiveness of the U.S.high-energy-physics program.

The COV did not have the time or the appropriate documentation to conduct an in-depth review of the balance between the university and Lab programs. Similar balance questions exist relating to senior vs. junior researchers and Lab/university funding balance across the frontiers.

The Office of Science is developing its electronic data base (PAMS) to manage all aspects of program management. The first partial roll-out was in 2011. The full roll-out of PAMS during the coming year should streamline the HEP management of the program, allow more complete characterization of the program, and make future COV reviews more efficient.

The time between proposal and notification of outcomes to proponents, and provision of redacted referee reports has improved but can be further improved. The strength of administrative support for grant processing may be inadequate.

HEP has re-organized its Accelerator R&D management through the General Accelerator R&D program focused on HEP. There are connections to SciDAC (Scientific Discovery through Advanced Computing) run by ASCR. Recently the Office of Science-wide Accelerator Stewardship program was initiated, with the BNL Accelerator Test Facility as its first component in FY14. Thus the HEP accelerator program serves stakeholders ranging from HEP, through other Office of Science Divisions, to the wider public. The new multi-pronged program will require careful planning and organization.

The Accelerator Stewardship program was instituted after the period considered by this COV review, but there were presentations and discussions with program managers during the review. It is important that this program be structured so as to serve the broader needs of the Office of Science.

Long-term programs devoted to improvements of existing facilities (e.g. the Fermilab Proton Improvement Program, and some Accelerator Improvement Project general-plant-project programs) could benefit from project-like review to establish their costs, milestones, and deliverables. Some such programs have suffered delays owing to Lab budget constraints and other priorities. Such reviews could be conducted using project-like methods either by the host Laboratory or by DOE.

The Facilities Operations considered were the Fermilab Program, LHC detector operations, FACET, LARP, MAP, and ILC. The program management was found to work well in most cases.

HEP managed 17 projects during the period reviewed, ranging from new starts to completions. HEP oversight was good, and flexible enough to meet the problems that were encountered. Project success is measured by the final cost (< 110% of original TPC). There is no requirement that the original project schedule be met, and delays have become the norm. New projects at the CD-0 and CD-1 stage have been developed so as to be ready for baselining if funds become available. ARRA offered such an opportunity.

In light of these findings, the COV made 34 recommendations.

1. HEP should strive to keep the overall program management coherent, keeping in view the connections and balance among the frontiers and minimizing the obstacles to well-motivated transfers of funds across frontier boundaries.
2. Continue the comparative reviews. These should be augmented with independent mail-in reviews.
3. Ensure that comparative reviews evaluate a particular proposal in the context of the full program over the full 3-year cycle within each frontier.
4. Ensure that review committees are given appropriate charges, that there are sufficient reviewers of each proposal, and that program manager oversight of reviews is uniform.
5. Modify the FOAs to request that proposals which address topics in several different review panel areas include a discussion of the synergy gained from this broader scope.

6. Institute mechanisms to streamline the movement of PIs moving from one frontier to another. The past record of such PIs should be considered in the reviews.
7. HEP should charge the comparative review panelists to collectively discuss the relative strengths and weaknesses of proposals so that the program managers can judge the relative rankings of proposals.
8. Ensure that program managers' comments in grant folders clearly document the reasons for the action taken.
9. Work to further reduce the time between proposal and proponent notification and to provide appropriate redacted review comments that will enable PIs to refine future proposals. Provide information to proponents on their comparative review score and the distribution of scores over all proposals reviewed by a panel.
10. Work with the community to leverage and coordinate funding sources for the HEP research program such as university startup packages or other non-DOE funding sources.
11. Further increase in the budget fraction devoted to projects is desirable but should be subject to the recommendations of the 2014 P5 report and budget constraints.
12. Allocate a few dedicated pages in proposals for senior research scientists to describe their activities and critical accomplishments.
13. Once goals, milestones and costs have been established for small-scale experiments, formal HEP project oversight should be kept to a minimum.
14. HEP should develop a coherent and stable approach to funding detector R&D which embraces the broad range of proposals for new ideas and techniques appropriate to its mission.
15. An additional IPA serving the theory program should be found.
16. Seek to increase the HEP travel budget.
17. We urge HEP to redouble and improve its communications both with the HEP community and in the wider governmental circles.
18. Undertake a separate review of the balance between the Laboratory and university research programs.
19. Make previous proposals and levels of support available to reviewers.
20. If there are clear guidelines on cost-of-living allowances for overseas experiments, provide them to the reviewers.
21. The management of the research, operations and upgrade components of the LHC experiments should be closely coordinated.
22. Consider a mechanism for seeking factual clarification of proposals from the PIs during the comparative review process.
23. Improve the quality of HEP administrative support.
24. Maintain U.S. science in the lead of the Cosmic Frontier.
25. Support computation, simulation, and phenomenology that are directly needed for planning, execution, and analysis of Cosmic Frontier Stage-III and Stage-IV experiments.
26. HEP should explicitly recognize that a thriving theory program is essential for identifying new directions and opportunities for the field, in addition to supporting the current program.
27. Create a new theory postdoc fellowship program, with recipients chosen via national competition and supported for three years at any DOE supported university or lab group of the recipient's choosing.
28. Evaluate the General Accelerator R&D (GARD) program to identify and prioritize components that are central to the evolving HEP mission, after delivery of the 2014 P5 report.
29. Identify goals and areas of mutual and/or complementary accelerator R&D interest jointly with other parts of the Office of Science and other agencies and stakeholders, at the foundation of the Accelerator Stewardship program.
30. Establish procedures to jointly review proposals addressing Accelerator Stewardship goals, including those outside traditional boundaries, at the initiation of the program.

31. Review the progress of the Accelerator Stewardship program periodically (e.g., annually), reporting to HEP, including reviewers representing other parts of the Office of Science, and representing other governmental agency stakeholders. Consider including SciDAC accelerator activities in the periodic reviews.
32. Perform project-style reviews for programs that have significant budgets and extend over multiple years.
33. Request that the LARP leadership address the recommendations from a compilation of the 2010-2012 LARP reviews.
34. Monitor activities that are transitioning from R&D to full construction (e.g., LARP magnet program) so as to clearly define and track the transition steps.

Erbacher or asked if this were an up or down vote or whether amendments could be made to the report. Lankford replied that the Panel has to approve this report before the report can go forward. Changes can be discussed and voted on. It is not desirable to fine-tune the report. Erbacher stated to Grannis that the Panel appreciates the thoughtfulness that went into these recommendations. On comparative review, she did not understand Recommendation 10. Grannis replied that many COV members did not think it a good idea to delay funding because of the possibility of other funding. Jawahery said that the COV recommends the gathering of additional information to clarify the understanding of the science.

Bishai asked who sets the definition of a small project. Grannis replied that there is a formal definition of $5 million for a program. Anything below that is a small project. The COV felt that the smaller projects should not be interfered with.

A break was declared at 3:07 p.m. The meeting was called back into session at 3:27 p.m.

Glen Crawford was asked to present the Office's initial response to the COV report.

HEPAP was charged in Sept 2013 with conducting an external review to assess the operations, process and procedures of HEP in SC, and evaluate the resulting research portfolio.

The COV met in Germantown, Maryland October 9-11, 2013. The Report of the COV was presented to HEPAP December 6, 2013. The Report contained 34 distinct recommendations.

HEP will issue a formal response to the COV recommendations within 30 days; the following responses are preliminary and subject to change.

The COV was charged to assess, inter alia, the efficacy and quality of the processes used to solicit, review, recommend, and document application and proposal actions, and to monitor active awards, projects and programs, and how the award process has affected the quality of the resulting portfolio for the period FY10-12.

The COV made 34 recommendations and suggestions that are here responded to sequentially.

Rec. 1: The Office agrees with the principle of maintaining connections and balance among different tiers, and will work to develop mechanisms to maintain coherence among programs and ease funding transfers across program boundaries as consistent with programmatic needs and priorities.

Rec. 2: The Office agrees to augment the comparative reviews with independent mail-in reviews.

Rec. 3: It is difficult to require reviewers to evaluate the full program for large umbrella grants. The Office will consider adding appropriate guidance to the FOA and the reviewer instructions to emphasize the context of the full program when evaluating proposals.

Rec. 4: The Office agrees that review committees should be given appropriate charges, sufficient reviewers, and uniform manager oversight.

Rec. 5: The Office has already provided guidance to PIs on preparing a better common narrative in proposals that address topics in several review-panel areas.

Rec. 6: The Office will consider appropriate measures to ease transitions of PIs across frontiers while noting that it is incumbent upon the PI to provide context and a relevant past record of achievement in the proposal.

Rec. 7: Review panelists currently collectively discussed the relative strengths and weaknesses of proposals in all comparative review panels.

Rec. 8: The Office agrees that program managers should really document the reasons for the action taken in each grant folder.

Rec. 9: The Office will continue to work to reduce the time between proposal deadlines and final decisions and providing redacted reviews. It will also consider providing comparative review scores or other indicative measures of a proposal's relative ranking within a given panel for future comparative reviews.

Rec. 10: HEP will continue to optimize its resources in coordination with other funding providers to advance the goals of the HEP research program.

Rec. 11: The Office agrees to increase the budget fraction devoted to projects.

Rec. 12: The Office will take under consideration the allocation of a few dedicated pages in proposals for senior research scientist to describe their activities and critical accomplishments.

Rec. 13: The Office agrees with the principle to keep formal HEP project oversight to a minimum for small-scale experiments. Formal project oversight should be the minimum necessary to successfully manage and execute the project.

Rec. 14: The Office agrees to develop a coherent and stable approach to funding detector R&D.

Rec. 15: The Office has already found a new theory IPA.

Rec. 16: HEP does not control the HEP travel budget (SC does and has cut travel across the board).

Rec. 17: The Office agrees to improve communications with the high-energy-physics community and wider government circles. To that end, the Office has enlisted an American Association for the Advancement of Science (AAAS) fellow and will look for other ways to improve communications.

Rec. 18: The Office expects the issue of undertaking a separate review of the balance between laboratory and university research programs to be taken up by HEPAP.

Rec. 19: The Office disagrees that previous proposals and levels of support should be made available to reviewers. Previous proposals are generally not considered relevant to the case under review. The previous level of support tends to bias the discussion of proposals and their relative ranking, and is contrary to one of the primary purposes of comparative reviews and findings of the 2010 COV: judge the current proposal on its merits, not the past history of the group.

Rec. 20: Clear guidelines on cost-of-living allowances for overseas experiments have been provided to reviewers, and the Office will continue this practice.

Rec. 21: The Office agrees that the DOE managers of the LHC programs should meet regularly.

Rec. 22: The Office disagrees that reviewers should be able to seek factual clarification on proposal issues from PIs during the comparative review process. Once proposals are under review, we do not contact the PIs for any reason until funding decisions are made. This practice is designed to avoid any unfair advantage that might be gained by PIs who have additional interactions with PMs during proposal reviews. As a practical matter, obtaining timely factual clarifications during the course of a panel review can be difficult. Individual PMs have actively worked in 2014 with the PIs to provide guidance in writing clearer proposals.

Rec. 23: The Office agrees to improve the quality of the Ministry of support.

Rec. 24: The Office agrees with the sentiment of maintaining U.S. science in the lead of the Cosmic Frontier. The integration of the Cosmic Frontier with the other, traditional HEP experimental areas is one of the signature successes of the U.S. high-energy-physics program.

Rec. 25: The Office agrees to support computation, simulation, and phenomenology for the upcoming Cosmic Frontier Stage-III and Stage-IV experiments.

Rec. 26: The Office agrees that it should recognize that a thriving theory program is essential for identifying new directions and opportunities for the field in addition to supporting the current program.

Rec. 27: The Office agrees with the importance of postdoc support in the Theory program and will attempt to develop additional modes of support for these positions.

Rec. 28: The Office agrees to evaluate the GARD program to identify and prioritize components that are central to the evolving HEP mission after the delivery of the 2014 P5 report.

Rec. 29, 30, 31: The Office agrees with the principles of identifying common goals and interests with other parts of SC and other agencies and stakeholders; jointly reviewing proposals addressing accelerator

stewardship goals; and reviewing the progress of the accelerator stewardship program with representatives of our other SC offices, other government agencies, and the SciDAC leadership. Accelerator Stewardship is intended to be a coordinated SC-wide program managed by HEP, and is (as yet) a proposed new subprogram that has not received Congressional approval.

Rec. 32: The Office agrees that project-style reviews should be conducted for programs that have significant budgets and extend over multiple years. Such review has been done on an ad hoc basis in the past.

Rec. 33: The Office agrees to request that the LARP leadership address the recommendations from a compilation of its prior reviews.

Rec. 34: The Office agrees to monitor activities that are transitioning from R&D to full construction to clearly define and track the transition steps.

The HEP COV members and particularly the Chair were thanked for their hard work and valuable input. It is expected that the current round of recommendations will continue to drive this cycle of improvement.

Fisher asked if universities are legally required to report any startup funds. Crawford said that he thought not.

Steinhardt asked if Crawford could clarify what he had in mind in Item 27. Crawford replied that there are various training programs and there is workforce development. The Office staff is discussing whether these efforts should be focused on particular areas or broadly across the Office. Steinhardt asked about honorific competitive scholarships or fellowships. Crawford replied that we will have to see what SC comes up with as being allowed.

Lankford asked Crawford to clarify his response to Recommendation 10. Crawford answered that this is a response to what he interpreted as the COV's meaning and what it wants the Office to do. Basically, the response is that the Office will coordinate and leverage funding sources. Grannis agreed that the wording of that recommendation is not optimum. The COV was worried that startup university support would be behind the award being made, and it did not think that that was an appropriate criterion for the award.

Jawahery said that, in Recommendation 12, the COV seemed to see a trend in reducing the recognition of the research scientists and asked how that translated into HEP's policy in regards to the research scientist. Crawford said that, since these people are viewed to have an influence on the project's success beyond that of a postdoc, they should have some extra space to detail what they bring to the project. He considered this reasonable. If the person is going to be supported by the grant, his or her contribution should be detailed. Grannis added that senior research personnel are largely found at the national laboratories doing relatively technical work.

Lankford opened the floor to discussion of the report. Erbacher stated that senior researchers bring other benefits to a project. Reviewers should know how to approach a senior researcher. The reviewer should have additional information about senior researchers so everyone is on the same page. Grannis said that the COV is charged to look at what has happened in the past 3 years. The COV did not find that there was any inequity but wanted to appreciate the contributions that these people have made. There were cases where there were inequities, but not in the cases of senior scientists. Lankford asked who should specify who is a senior scientist. Erbacher replied that she did not know; maybe the COV or HEPAP. Crawford suggested that it could be done in the guidance given to reviewers and to program managers. A distinction is drawn between operations and research here. Those who are doing operations should be reviewed under operations, not research. Erbacher said that if a university does not have a researcher who has not been funded for years, it seems that money is being taken away from universities and given to the national laboratories. Crawford said that there are real issues here that need to be studied.

Rosner asked what prevented something being proposed year after year. Crawford replied that the program manager can flag that situation.

Bishai asked where the definition of the $5 million cut-off for small projects came from and whether it was appropriate. Crawford replied that it is a DOE corporate issue subject to DOE orders. Procario added that the Office has to follow those orders; that said, the Office tries to tailor the level of oversight to

the need. Grannis remarked that the COV did not look at the cut-off system but at how well the Office did in following procedures.

Byrum noticed that there had not been a response to the recommendation about rotating program managers every 5 years. Crawford replied that that was an interesting concept but not a recommendation. Byrum asked how the Office planned to reconcile migration across frontiers to the funding caps for each frontier. Crawford said that the Office has been going through years of unequal decreases in funding. Adjustments have to be made from one program to another when problems occur. P5 will probably discuss this issue. Grannis added that physics is connected in a way that the techniques are not. It is not desirable to have the boundaries become ossified.

Tschirhart said that the charge asks how responsive HEP has been to the P5 plan, but he did not see that topic summarized anywhere. Grannis admitted that the COV had failed to address that question overtly. The issue was threaded throughout the discussions of the COV. Tschirhart said that it would be good to make a statement about how the recommendations of the P5 plan were followed. Lankford asked if that should be added to the report. Grannis replied that he would prefer to take that issue back to the COV for discussion. Tschirhart agreed that that would be valuable. It was in the charge, as is the question about maintaining a healthy university and national laboratory program. Honscheid agreed with that assertion, as did Fisher. Bishai asked if there were consideration of a slush fund for multidisciplinary projects. Crawford said that that is not how the procedures are set up but it has been discussed. Funding has been so tight that it is difficult to carve out money for anything.

Lankford noted that DOE disagrees with two recommendations (19 and 22) and asked how others deal with these issues of the procedural conduct of comparative reviews (making previous proposals and levels of funding available to reviewers and seeking additional information from PIs during the review). Caldwell said that the NSF does not do either of these actions. Once the review process is started, it does not go back to the PI. Afterwards, the program manager might go back to the PI for clarification. Gerber noted that other agencies ask for funding levels from other projects. Gonzalez-Martirena said that that is standard for all proposals to the federal government.

Rosner asked if there were any breakouts of senior research associates in the forms and whether they contribute to the proposal. Caldwell said that, at the NSF, the PI determines how much a senior research associate contributes to the proposed project and to the proposal itself. Fisher noted that he had been asked to contribute his CV to a proposal and that he got good guidance about how to participate in the proposal.

Lankford said that he did not see a one-to-one correspondence between the recommendation of communications and the HEP response. Grannis replied that, in the communications to the community, the community was not listening well; other government agencies seem to get the word out about successes faster and more abundantly than does HEP. Crawford agreed that HEP should take the time and effort to do that.

Tschirhart said that, in Recommendation 32, there seemed to be a confusion in the meanings of terms used (like “projects” and “milestones”). Grannis answered that different adjectives were used at different times. The COV wanted a more formal approach to long-term activities. The feeling was that it was the national laboratories’ responsibility to stabilize the ups and downs, but a review process may be a way that DOE could lend some stability. Procario commented that that would make a national laboratory write down a plan of what it expects to do. It would be outside the critical decision approval process. Siegrist noted that a funding profile could be set in an agreement between HEP and a national laboratory. Grannis said that the COV wanted to see some protection for long-term projects. Fisher asked if there were a viable alternative here. Grannis said that he was not sure that this COV will agree. To call it rigorous management would be the preference.

McBride asked what the recommendations were for improving laboratory comparative reviews. Grannis answered that there are not enough data to analyze them yet. Therefore, the COV put the issue off to the next COV. There is not a pre-judgment that the laboratory reviews are broken. This COV did not look at it enough to make a recommendation; there was not a long-enough assessment.

Lankford summed up the additional work needed on the report:

1. Recommendation 10 needs to be reworded.
2. Two elements of the COV charge need to be addressed: has the Office been responsive to the P5 plan, and is the Office maintaining a healthy laboratory and university program?
3. Consider a different adjective than "project-style" in Recommendation 32.
4. Reword Recommendation 27 to be less specific.

Steinhardt asked if the COV considered how the postdoc program was working. Grannis replied that the COV had people from the astronomical side. The intent was that the postdocs would go to a DOE program. How this might perturb postdoc hiring did not come up. Part of the motivation was putting a lien on future funds. It was discussed in a subcommittee, not by the full COV.

Lankford pointed out that this was a topic that was expected to be discussed on the following day.

Erbacher opined that these postdocs should be awarded at the same time scale as other postdoc programs. Ligeti made the observation that only a handful of institutions would benefit from this program. Steinhardt noted that there are complicated rules so the postdocs do not bunch up and suggested the development of a proposal. Fisher said that, if one had an HEP program, one could tell them where to go rather than their choosing where they got the best deal. One has to determine what the goals of such a program would be.

Lankford pointed out that the Panel needed to determine what the COV report is to say and whether any recommendation was to be removed or altered. Grannis stated that the report could offer a proposed solution. Han said that they could be rewarded on the merit of the proposal. Lankford asked if Grannis were proposing taking this recommendation back to the COV. Grannis replied, yes, to make it simpler and more generic. The panel expressed approval of that path.

Lankford said that the Panel should define the four areas for reworking, Grannis could take it back to the COV, and the final draft report could be voted on by e-mail. The sense of the panel was to follow this procedure.

Lankford thanked the COV members for their hard work.

Robert McKeown was asked to report on the activities of the Nuclear Science Advisory Committee (NSAC) Subcommittee on Neutrinoless Double-Beta Decay.

Back in 2005, the Neutrino Scientific Assessment Group NuSAG considered neutrinoless double-beta decay and recommended an R&D program of two or more experiments because of a claim of a signal discovered in experiments conducted in Germany. Several projects are under way and are producing data. DOE has agreed that the Office of Nuclear Physics (NP) would be the steward of these projects. This past year, NSAC had to report on facility needs to SC and it put neutrinoless double-beta decay at the top of its list.

Recently, NSAC, which was a partner of HEPAP in NuSAG, got a draft charge that is not yet public. (It will be made public on December 19.) The charge will be to assess the status of neutrinoless double-beta decay and provide criteria for down-selecting methods for pursuing this research. The intention is to establish a 2-year standing subcommittee of NSAC with its first report to be made in April 2014. The Subcommittee has been set up. It has 15 members. McKeown is the chair. There are two HEPAP and two P5 members on the Subcommittee. It also includes theorists. The first phone call was the same day as this meeting. The Subcommittee will be soliciting input from the ongoing projects.

Lankford noted that there was a lot of interest in the science in the high-energy-physics community. The Panel is glad to see its members participating in the Subcommittee.

Tschirhart asked what the scope and scale were of the down-select experiment. McKeown replied that the current projects are operating with detectors in the 10- to 200-kilogram range of mass. The mass of the down-selected experiment would be greater (about 1 ton), and the cost would be more than $100 million. It would need to have a sensitivity to cover the whole band of the inverted hierarchy. A lot of information would have to be collected from proposers and insightful questions devised. Tschirhart asked what the impact would be on the program. McKeown responded that that depends on the mass of the neutrino and the overlap of the hierarchies.

Byrum noted that NP was the steward and asked if both HEP and NP physicists would be involved. McKeown replied that one agency or the other (DOE or NSF) might fund construction. That could be

problematic. The two offices would have to work it out. Crawford added that NP would do the heavy lifting on the project, but HEP personnel might be involved in the operations. Gillo pointed out that there was a lot of concern at OMB about this issue. The administration is in favor of the project, and it is something that the two offices can work on together.

The meeting was adjourned for the day at 5:22 p.m.

Saturday, December 7, 2013

The meeting was called back into session at 9:00 a.m. **Andrew Lankford** led a discussion of accelerator R&D.

Accelerator R&D is crucial to the future of particle physics, for both the midterm and the long term. Particle physics demands a healthy, multi-faceted program of R&D focused on accelerator projects in the foreseeable future, enabling technologies for new accelerators in the more distant future, and striking a balance between "directed" and "basic" accelerator R&D. The program also needs to be focused on numerous technical subjects, such as novel concepts for acceleration; superconducting radio-frequency; accelerator, beam, and computational physics; particle sources; beam instrumentation and control; normal gradient/high gradient structures and radio-frequency sources; superconducting magnets. Accelerator test facilities and basic accelerator science also need support.

Accelerator R&D is already a major commitment of the HEP program and a significant fraction of the HEP budget (15 to 20%). It is a new thrust for NSF in its treatment of basic accelerator science

The national accelerator R&D program has been brought into focus recently by the HEP COV and P5. The COV said that "The [GARD] program thrusts largely reflect the history and past priorities of HEP, rather than the current understanding of the medium- and longer-term needs of the domestic HEP program. The most notable omissions include R&D on the enabling technology of high-power targets, on research towards future high-power proton accelerators, and on the Intensity Frontier (discussed in the 2013 Snowmass report and elsewhere). Reconsideration of the GARD portfolio will therefore be needed soon, synchronized with the delivery of the P5 report in 2014. It is desirable and even necessary to identify activities that are central to the HEP mission, and therefore properly located within the General Accelerator R&D (GARD) program, and to distinguish them from activities that are more suitably included under the category of Accelerator Stewardship." The COV recommended that HEPAP "Evaluate the General Accelerator R&D (GARD) program to identify and prioritize components that are central to the evolving HEP mission, after delivery of the 2014 P5 report."

P5 is charged to conduct "a critical examination of the investments that would be needed to ensure the vitality, scientific productivity, and discovery potential of U.S. high-energy-physics research during this timeframe. Specifically, [it is requested] that HEPAP examine current, planned, and proposed U.S. research capabilities and assess their role and potential for scientific advancement; assess their uniqueness and relative scientific impact in the international context; and estimate the time and resources (the facilities, personnel, research and development and capital investments) needed to achieve their goals." P5 is also to articulate "the approximate overall level of support that is needed in the HEP core research and advanced technology R&D programs to achieve these opportunities in the various scenarios." Investment in accelerator R&D competes with other elements of HEP program. P5 will only be able to address accelerator R&D with a broad brush. Defining a detailed R&D plan is beyond its scope and means. It will articulate an approximate overall level of support for R&D.

As a follow-up to the COV and P5 reports, a HEPAP subcommittee composed of HEPAP members and others could be given a flexible mandate to define the general goals of the accelerator R&D program; recommend a balanced program within budgetary guidance; and suggest an appropriate mechanism to monitor, review, and update the program. Such a subcommittee might also report on the current demographics and capabilities of the HEP community engaged in accelerator R&D; assess the manpower and capabilities requirements of the program; comment on how to match resources and requirements; and articulate national-laboratory and university roles, cooperation, and balance. He said that this subcommittee might be asked to report at the summer 2014 HEPAP meeting, report its preliminary

findings at the time of the P5 report, and present a follow-up report on demographics and capabilities at the fall 2014 HEPAP meeting.

Ben-Zvi said that formulating such a subcommittee is a good idea. The time scale may need to be expanded. This was recommended by a subpanel of P5. Siegrist said that a stewardship program validates the pursuit of accelerator R&D, and the Senate mark has extra money for stewardship. This wider role is something that should be considered. Ben-Zvi noted that the NSF adopted the recommendation very specifically to move industry into the field.

Hoffstaetter asked how BES and others would fit in. Lankford replied that he was coming from a narrow HEP perspective. The challenge of the P5 process is making ends meet while pursuing broad goals. Other offices and agencies will be engaged to meet the broader goals. The stewardship program would provide the accelerator R&D needed by other SC offices. It would be good to know what capabilities from outside the HEP community could be brought to bear on HEP's problems.

Colby noted that it is not just the industrial aspect; industrial applications are just one part of the program. The core concern is how accelerator technology can serve the needs of the offices of SC and other federal agencies.

Siegrist asked, on this timescale, would a broader look be of value to the accelerator program? Colby responded that the question is better framed as, what is the proper investment in accelerator R&D as opposed to the overall HEP program? This should heed the advice of P5 and how the goals of P5 are to be met by the GARD program. The Accelerator Stewardship Program is not funded yet, and there is no executing program to look at the results of.

Lankford wanted to add to the perspective the activities of other laboratories around the world that contributed to HEP's objectives, adopting an outside-in approach as well as an inside-out approach. Hoffstaetter said that his concern is including the outside-in perspective. Bishai pointed out that there is a lot of overlap with activities worldwide and with proton machines.

Gilchriese asked what drives the timescale, which is ambitious. Lankford said that things need to be moved along efficiently to provide goals within budgeting guidance.

Sutter said that this program was started under his guidance at HEP. NSAC and BESAC were worried about whether one could build the technology to push the current machines to higher levels of performance. The effort is curiosity-driven. An accelerator awareness program was started, and there is now an accelerator school. There is long-term R&D (to build a research machine) and short-term R&D (to upgrade current machines). There is also a mid-term regime in which one tries to get the R&D results adopted by industry and bring the concepts to commercialization. The big money will be in the short-term R&D; the long-term R&D may get lost in the process.

Lankford pointed out that the objective of the analysis is to define the goals of the R&D program.

Merminga said that the intersection between R&D and the needs of accelerator users and operators needs to be identified. Lankford replied that looking at what can be provided to others is the inside-out perspective. Merminga responded that members from the other offices of SC and from the COV, as well, should be included.

Tschirhart said that there is a need for that broader view. Doing this in two steps would result in (1) finding requirements and (2) defining the stewardship process/program. Hoffstaetter asked if educating students to operate and use accelerators in general was being looked at. Lankford agreed that that should be done; it would be in a later version. He asked if the agencies would want to take this task on. Siegrist replied that trying to break this into two steps would allow the Office to aim GARD at its own needs and then to take on others' needs. Ritz asked whether they would report their findings simultaneously with the report of P5. Lankford replied that there are numerous timescales to address. P5 will overlap with several. P5's task should be made easier, not more complicated.

Byrum agreed that other people should be brought in to look more broadly than just at HEP. Lankford agreed that it would be good to have broader expertise than just that of HEP.

Steve Ritz was introduced to present an update on P5's activities.

The charge was to develop an updated strategic plan for U.S. high-energy physics that can be executed over a 10-year timescale in the context of a 20-year global vision for the field; to conduct an

assessment of the current and future scientific opportunities over the next 20-year period; to carry out a critical examination of the investments to ensure the vitality, scientific productivity, and discovery potential of U.S. high-energy-physics research; to consider the appropriate balance of small, mid-scale, and large experiments, and to identify, where possible, multiple or complementary pathways to address the important scientific questions.

Snowmass output is essential input to P5. Most meetings will have public components, be geographically distributed, and have a lot of interaction with community members about P5, the process, and the issues. The P5 website is up and running.

Community buy-in is critical to P5's success. The process, as it develops, will be inclusive and clear. The rationale for the choices must be articulated. Note that it is possible to support a plan even if it does not match one's specific taste in physics.

Currently, P5 has a website with news, a Web submissions form so anyone can add information, a list of meetings and webcast information, and internal P5 web-based tools.

Meetings have been set up and held. The first day of the first meeting (at Fermi Lab) was devoted to a discussion of the results of Snowmass. Each speaker was polled to see what he or she thought P5 should know. The international context was also discussed. The second day was dedicated to the neutrino program. The town hall meetings are carefully orchestrated to allocate time fairly and to ensure 90 minutes open discussion. Written submissions are allowed. The second meeting was held at SLAC. A dialogue was engaged with various communities, such as cosmic physics, astrophysics, and computing.

The upcoming meeting will be four days at BNL. The first day will be dedicated to the LHC upgrade and the international linear collider (ILC). The second day will be devoted to the accelerator complex for the LBNE, high-intensity proton beams, specific projects like g-2 and the Coherent Muon-to-Electron Transition (COMET) experiment, a future circular collider, a neutrino factory, and others. A town hall will be held. The third day will consider accelerator R&D, instrumentation R&D, and additional topics. A full-day executive session will round out the meeting.

There is also P5 alone-time. There will be face-to-face meetings in January and February with more to follow.

P5 has had three 90-minute phone calls so far before/between face-to-face meetings to keep work moving forward. This will continue.

P5 is taking advantage of other ongoing studies and paying close attention to process and scope. It is thinking carefully about report structure and effectiveness. A short report is better than a long one. Narratives will cover what do we want to learn, how do we want to get there, how do the pieces fit together, and what is essential and why. It will represent a global context and show the interdependencies. A robust plan is needed. Scientifically, this is a *great time* in particle physics, but budgets are severely limited.

Community input and feedback is necessary throughout the process. Multiple community emails are being sent out, including messages targeted to younger physicists. P5 needs HEPAP's feedback on the P5 process, on preliminary findings, on the draft report, and on how to communicate the results within our field to decision makers and to our colleagues in other fields.

Gilchriese asked how much detail would be available to HEPAP so they can check whether P5 made the right selections. Ritz replied that P5 has spreadsheets that show possible budgets. Those numbers are speculative and should not be released. Lankford pointed out that the issue should be whether the report is clear and convincing. Ritz agreed. A further question is whether the scope envisioned by P5 was fulfilled. An execution plan is not being produced; that is what the agencies do. P5 is providing guidance for that.

Honscheid asked if the process would be affected by the departure of HEPAP members. Lankford responded that, at the March meeting of HEPAP, both the outgoing and incoming members will be present. The approval and transmittal will be left to the active members at that time.

Tschirhart asked whether P5 will speak to project fraction in its report. Ritz answered that P5 will urge a balanced account and will take that into consideration. P5 has not discussed the execution and probably will not mention any budget number. Tschirhart said that, if it is not constructive, it should not be done. However, it affects everything. Ritz responded that P5 has to deal with that. It heard what has

happened with theory, and it is reacting to that situation. What it says in the report will not be helpful if it is too explicit.

Byrum pointed out that, after all these discussions, most physics efforts are in the Energy Frontier, and most of the money is in the Intensity Frontier. P5 should listen to Dehmer's message that she presented yesterday. The entire community is counting on P5. Ritz noted: (1) One sees those "binning" words in the Snowmass report, but one does not see them in P5's meetings. That is on purpose; P5 is trying to free up its thinking. (2) On the fraction devoted to projects, there is no discussion that is off-limits to P5, but that issue has not come up (yet). (3) The best directions in science are not selected democratically. Science is dynamic, and different opportunities present themselves. Just because people work in one area today does not mean that they will be working in that field tomorrow. The scientific opportunities must be put first. One needs to clearly explain the scientific opportunities and imperatives.

Ligeti pointed out that how one establishes the costs of these projects can influence the selection process. Ritz agreed. It has to start with the science. There *is* a physics per dollar aspect that comes into play. The report is not a novelization of the spreadsheets; the choices are a reflection of the budget realities. The report is a planning document.

McBride said that the sharing of the spreadsheet conclusions at the Fermilab meeting helped communicate the problem. Lankford said that anyone can do this exercise. McBride agreed, but it was really helpful in elucidating the planning process. Ritz pointed out that there are precedents that should be looked at. McBride asked what his sense was on progress on the different parts of the charge. Ritz replied that there are some priorities. For March, P5 needs to set scientific priorities. Progress has been made on the other questions (overall health, balance of funding, etc.) but not enough to make a definitive statement about them. P5 is moving along on different topics in parallel but not touching research budgets at national laboratories and universities, which is outside P5's purview. Every question will be answered in the report. Some fact-finding will have to be done. P5 is looking at phasing, data analysis, etc. about the projects. When it gets all that information, it will take a hard look at the compiled facts and see if it has a complete set of information. Many of those questions were helpers, not something that was wanted in a 10-page analysis. P5's plate is full.

Bishai said that P5 must prevent HEP from becoming fractionated; however, it must make a convincing case about the science. She asked if P5 were willing to push back on funding boundaries. Ritz responded that pushing back is a good strategy. These things come and go and will come up after the report comes out. Further discussion with the agencies is needed to take budget conditions into account. He was convinced that the door is open for P5 to be bold in making its case, and it will probably do that; it is essential.

Gerber asked how P5 was considering the unconstrained budget and urged a moderate inclusion of some of the more interesting projects. Ritz replied that P5 will not lump the small projects together in "everything else." It will give reasonable suggestions.

Erbacher thanked him for this overview; the Subpanel is doing a great job. She agreed that the ballpark numbers would be useful, as McBride suggested. In prioritizing based on physics, demographics does come into play. The need for a U.S. program is important, also. She asked how P5 will take that into account. Ritz replied that these are important questions. Just because a program keeps a field alive and the domestic laboratory alive, that is not enough. P5 has a 10- to 20-year horizon to look at and has to plan how to get there. Facilities are needed that are healthy and thriving and producing good science for the world. It has to be primarily motivated by the science and then these other issues. What is going on at CERN is part of *HEP's* program. What HEP is doing there is great U.S. physics. DOE needs to take more credit for what it does. Erbacher added that the term "lost leadership" should not be used; the United States is doing a lot at the LHC. Ritz added that any such big flagship facility here must have international participation. The United States builds a lot of off-shore experiments here and analyzes the data here.

Honscheid pointed out that the choices that P5 makes will affect student enrollments and programs at universities. Ritz and said that he had asked for a national timeline of results coming in from these plans. P5 will look at what kinds of results come out, when they are to come out, and what effects it will have on individual choices.

Ligeti asked to what extent P5 was concerned about the *science* when it was addressing the charge. Ritz replied that (1) one could talk about scientific priorities but not without considering how to build it. P5 needs to look at *opportunities*, an activity that considers both what is needed and what can be built. (2) He did not yet know the scientific consensus of the Subpanel. There is a continuum of projects across fields, and sometimes a project spans boundaries. P5 needs to discuss how to consider that.

Hobbs asked how one understands how to get to the next step. Ritz replied that, if it is an ultimate measurement, one is cognizant of the fact that that is the last step.

Steinhardt asked how P5 expects to take into consideration the timelines of international efforts. Ritz answered that that knowledge is incomplete and difficult for P5 to deal with. P5 has no mandate with any foreign government or program. It is constantly grappling with that issue. It is rapidly getting to the point where one country cannot do a program alone. There is an international component to all proposed programs. One has to look down the road.

Yamamoto noted that, even though there may not be constraints on the budget, there may be constraints on human resources and asked if P5 was taking this into consideration. Ritz replied, yes, that is why P5 is asking researchers about the number of FTEs required for each project. It wants to know if more workers would be needed than would exist.

A break was declared at 11:11 a.m. The meeting was called back into session at 11:31 a.m., and the discussion of P5 was resumed.

Tschirhart asked how P5 was dealing with costs and validation. Ritz replied that fact-checking is very important. P5 will double back and make sure it got the right information. It is using a standard set of questions to get uniform responses from all the projects and to parameterize uncertainty. It is looking at aggregation of small projects to guard against perturbations by large projects. The uncertainties are in project cost and in funding available. One has to live with that. The NRC spun off a cost-estimating group, an extensive and expensive thing to do. One still does not get a perfect answer because that group may not agree with a project's response, and the answer has to be negotiated; it is an imperfect answer. P5 needs to consider how to assess the quality of the cost estimates.

Han asked to what extent P5 is communicating with other planning activities globally. Ritz answered that P5 is communicating with all those groups and it actually has members who are connected with all members of those other groups. The P5 report should and will reflect these other, global, planning efforts. P5 has invited people who are knowledgeable to tell it what other planning efforts it should be aware of.

Erbacher said that HEPAP wonders how it can contribute meaningfully to the P5 report. Ritz responded that HEPAP has an important but not exclusive feedback responsibility. We at this meeting are doing that right now, and it will occur in March, as well. If a HEPAP member sees something that P5 is missing or a different way that P5 could look at and analyze a field, P5 would appreciate hearing about it by e-mail or through talking to the HEPAP chair. Preliminary findings will be presented to HEPAP in March.

Roe noted that P5 is planning a lengthy journey for high-energy physics. The route may need to be recalculated as that journey is made. She asked if P5 had considered some on-ramps and off-ramps and whether some decisions should be held in abeyance pending additional information. Ritz replied, yes! P5 has already begun discussing it. Roe said that the report's calling for a periodic update to the roadmap would be helpful. Ritz noted that that would be beyond the charge. If HEPAP wanted to add that to the charge, P5 could work on it. Lankford noted that that topic was on the list to be discussed in the next portion of this meeting.

Young said that everyone should feel that they have had input to the P5 process to produce buy-in. There has not been much input asked for in the prioritization process. He asked if there had been enough discussion of prioritization. Ritz noted that P5 had opened the door to such discussion. That input is important and helpful to P5. He asked anyone that he came in contact with to comment on P5's efforts. The response has not been as intensive as he would have thought. A year-long Snowmass assessment has just been completed, and P5 is looking at the outcome of that effort.

Ligeti noted that having the possibility of such a discussion in a public setting could serve multiple purposes. Ritz said that he would be happy to go back to the 27 people who gave input to see if they

would allow their comments to be made public. The webpage could also be modified to allow public or anonymous commenting. The problem with an anonymous process is what needs to be defined.

Erbacher noted that many members of the community could not attend the town-hall meetings but would like to participate publicly. It is an idea that P5 should consider. The webcasts of the town-hall meetings should be two-way discussions, also. Ritz pointed out that anyone who submits a comment over the website will be heard by P5. However, it is not P5's responsibility to maintain a community-wide discussion. Snowmass is where that discussion could be and was held. Ligeti said that he was not advocating a discussion board but how well one performs the prioritization process. Ritz asked why one would need to know what people are saying to P5. McBride said that, at this point, the process seems to be like a closed room, not a community discussion. Ritz pointed out that the submission form had never existed before; it is an attempt to open up the process. McBride admitted that not everything needs to be public. Ritz said that P5 can upgrade the "About P5" webpage. If HEPAP feels that P5 should make the discussions public, it will; however, there is a lot more work to be done. McBride pointed out that some town-hall meetings were scheduled when people could not attend, and people felt frustrated in not being able to contribute. Ritz said that it is impossible to maintain a discussion if it is opened up to the world. Everything is webcast but only in one direction: outward. P5 could set up an all-Web town-hall meeting. He asked if that would be helpful.

Teplitz asked whether the charge said anything about theory and whether P5 had any suggestions about productivity. Ritz replied, yes; it is there implicitly, and P5 had a session on theory at the second meeting.

Siegrist said that the agencies were very appreciative of the work that Ritz and all the members of P5 are doing.

Andrew Lankford initiated a discussion of future topics that HEPAP might want to address.

The COV report recommended that a "further increase in the budget fraction devoted to projects is desirable but should be subject to the recommendations of the 2014 P5 report and budget constraints and that a further increase in the budget fraction devoted to projects is desirable but should be subject to the recommendations of the 2014 P5 report and budget constraints.

The current fraction is research:projects = ~50%:~17%. The SC average projects fraction is ~20%. A research fraction <40% is viewed as not healthy.

The P5 report should articulate the scientific opportunities that can and cannot be pursued and the approximate overall level of support that is needed in the HEP core research and advanced technology R&D programs to achieve these opportunities in the various scenarios. But P5 must do so wisely. The research work force should match the project portfolio, and one should make sure that changes would not be made that do long-term damage to field. Beyond P5, "fine tuning" with regard to P5's assumptions may be useful. More careful study may be needed.

The COV also recommended a further increase in the budget fraction devoted to projects is desirable but should be subject to the recommendations of the 2014 P5 report and budget constraints.

In regard to national laboratory and university roles, the COV recommended that HEP undertake a separate review of the balance between the national laboratory and university research programs to optimize the breadth and depth of the program given current very tight budget constraints. HEP should have an overall strategy for some of the large issues that are communicated to the reviewers. These issues include the appropriate mix of lab and university funding levels, the role of the national labs that do not run facilities, and the numbers vs. the strength of the groups supported. This COV had neither the appropriate documentation nor the time to adequately assess the balance in the program between university and national-laboratory research programs. The COV stated that a future HEPAP subpanel should provide guidance on the balance of national-laboratory and university programs.

A possible HEPAP follow-up would be to establish a HEPAP subcommittee to address this issue in the context of other issues dealing with the respective roles of laboratories and universities in the execution of the optimal particle physics program.

Cvetic noted that there is a parallel discussion on theory and asked if this subcommittee would cover theory, also. Lankford replied, yes.

The COV report recommended that HEP allocate a few dedicated pages in proposals for senior research scientists to describe their activities and critical accomplishments and thereby improve the review criteria for senior scientists.

A possible HEPAP follow-up would be to raise this recommendation in the more general context of the discussion of senior research scientists by the HEPAP subcommittee formed to discuss respective roles of laboratories and universities. What are the roles of the institutions? What importance to projects do senior research scientists have**?**

On theory, the COV recommended the creation of a new theory postdoc fellowship program. Such programs at national laboratories and at some universities have been highly successful. A program that is open to the full spectrum of young theorists would be useful. There are several successful models for postdoc fellowship programs. HEPAP could raise this recommendation in the theory discussions of the HEPAP subcommittee formed to discuss respective roles of laboratories and universities. A discussion of the roles of institutions would be different if one were talking about theory or experiment and by the type of experiment being done. That is beyond the purview of this subcommittee.

The COV commented that separate comparative reviews for laboratory versus university theory are well motivated by programmatic differences between the two programs. The 2011 laboratory theory review panel and the FY12 university theory review panel had some overlap in membership. This is useful. It would be good to identify programmatic differences between laboratory and university theory in the context of the HEPAP subcommittee formed to discuss respective roles of national laboratories and universities.

The COV commented on the SciDAC program and accelerator R&D, saying that SciDAC is a good example of how HEP benefits from a program that is jointly run with another SC program office. There has been significant progress over the second and third generations of SciDAC. SciDAC accelerator code development might benefit from closer coordination with GARD, and in due course with the Accelerator Stewardship program.

There is informal coordination between SciDAC and GARD, but the desire to optimize the HEP rewards suggests the need for closer coordination and for better accounting of the needs of the code end users. The accelerator software activities within SciDAC could be reviewed to measure and ensure user satisfaction, with the assistance of HEP.

Is HEPAP follow-up called for here? If so, what follow-up would be appropriate, and would it roll into the mandate of an accelerator R&D subcommittee?

Siegrist said that, if the accelerator R&D digs deep into accelerator science, it should become part of the mandate. Merminga asked what the status of accelerator code development was. Siegrist replied that that is the topic of a computing workshop on the week after this meeting. It is a joint workshop with ASCR. It may or may not get a SciDAC grant. The Office is discussing whether this is the best way to serve the needs of the high-energy-physics community. Crawford replied to Merminga that the status varies across the community, with some researchers developing community codes and others feeling left out.

The Accelerator Stewardship program was initiated after the period that the COV reviewed, so is not part of the purview of the COV. However, because there were discussions with HEP staff on this program, the COV considered some ways to enhance the prospect for the stewardship program's success. HEPAP should probably monitor the development of the stewardship program via a report at a future meeting, say in the summer of 2014.

The COV report noted that the national laboratories serve as the contractors for major projects with the expectation that there will be university involvement, as appropriate, and said that it would be useful to investigate ways to facilitate enhanced contribution by universities. HEPAP should probably discuss this issue in the context of the HEPAP subcommittee formed to discuss the respective roles of laboratories and universities.

The COV urged a continuing effort to relax the current DOE travel policy and the deadlines imposed in their application, consistent with appropriate concern for efficiency and budgetary responsibility. Steinhardt noted that the APS meeting is in March in Savannah, and by the time the fellowships were

announced, the deadline for application for DOE funding to attend the meeting had passed. Travel plays a crucial role in international collaborative research. This is a government-wide issue; HEP is not going to get a special exemption. The APS traditionally bridges such issues to policymakers. McBride said that the International Union of Pure and Applied Physics (IUPAP) would profit from some data on changes on conference attendance. Steinhardt stated that, when terrible things were expected to happen, people came anyway (e.g., at Snowmass); the numbers may not be meaningful. Siegrist suggested that it may be good to bring this topic up when the advisory committee chairs meet with the new Secretary of Energy. This ruling came out of OMB; the data they need must be collected for them. It is mostly an APS issue.

In approaching the subject of the respective roles of national laboratories and universities, the COV recommended an examination of the balance between the national laboratory and university research programs. An approach to the discussion might be to start with asking: What are the missions of the agencies? How do national laboratories and universities contribute to agency missions? What are the missions of national laboratories and of universities in this context? What can agencies do to enable national laboratories and universities to fulfill their missions? The focus here is on how to best accomplish science goals in this context. What are the respective roles of the various types of institutions in accomplishing the program's science goals and in satisfying the missions of the program? How can roles and working relationships be defined (or redefined) so as to optimize science accomplishment and to satisfy missions?

It should be borne in mind that the DOE and NSF missions differ. One should consider how the DOE mission differs for Fermilab and multi-purpose laboratories and how missions or goals differ for large and small universities. How do the respective roles vary in experimental areas as experiments progress stage by stage from detector R&D through construction to physics analysis? How do respective roles vary in different areas of theory? How can roles be designed such that there are no second-class citizens? What degree of academic freedom should there be in theory, in experiments, at universities, and at national laboratories? What degree of mobility should be allowed within the field and to neighboring fields, such as theory or instrumentation?

Gilchriese asked why this has to be done soon when the P5 report will come out in March or May. Ligeti raised the question: How urgent are these different issues? The Panel can get a charge from the Office, or can institute its own subpanel, or can put it back to the same panel that had raised the issue. A number of these issues have been out there for a long time and should not be allowed to linger. The issuance of the P5 plan would be a good time to ask these questions and get the agencies some advice about how to use their resources. Siegrist noted that the urgency comes from how one executes the plan. This is the first block of the questions to be raised that have been festering a long time. Erbacher added that a comparative review process is being instituted and refined, so this would be a good time to deal with these issues. McBride agreed, especially in view of the expected cuts in research funding.

Other topics that have come up in meetings but have not been discussed at length include: characterizing the workforce required to address the science and missions. What areas need to be expanded? What areas can be cut? What should be the profile of the field in terms of students, postdocs, faculty, and national-laboratory scientists? There is also the issue of mentoring, sociology of training, and workforce development. There is stovepiping within HEP and between HEP and other offices and between agencies.

How should future strategic planning be done? Should there be an international planning process? How should monitoring of the roadmap be done and at what level?

Does high-energy physics need a national program advisory committee (PAC) to prioritize and recommend small and medium-scale experiments and to monitor particle-physics program execution?

Erbacher suggested that reconvening P5 might be a useful way of dealing with changes that occur in the field and asked whether a PAC would make HEPAP redundant. Siegrist replied that PACs do a lot more than HEPAP does traditionally (e.g., they dig into experiments and how they are being conducted). Lankford noted that there are different types of PACs. One might watch the roadmap and tell HEPAP when an update is needed. Shutt asked, whose need it would fill, and who is not doing it now? Lankford answered that P5 discussed whether there should be a portfolio set aside for small experiments or

medium-scale projects. Someone is needed to set the conditions and evaluate candidates. Shutt thought that the concept is worth doing but issues of scope would have to be worked out. Siegrist added that it may work out as part of the discussion of the roles of universities and national laboratories.

McBride said that the situation is very complicated. It raises questions about who is managing and who is being advised and how it interplays with all the national laboratories and research projects. There are a lot of important details to consider. P5 is not just advising HEPAP but also the agencies directly. She did not want to increase the tasks of P5, but was concerned about that issue. Ritz suggested thinking of this from a project perspective, including all the review processes that one already has to go through.

Lankford asked whether HEPAP would be willing to work on any of these issues. He opened the floor to other business. He asked if anybody saw an issue on making the ReadyTalk recording publicly available. There was no objection. There will need to be two spring meetings in March and May to deal with all the work of the Panel.

There being no further business, the meeting was adjourned at 1:30 p.m.

Respectfully submitted,
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