Minutes of the Meeting of the
Department of Energy and the National Science Foundation
Nuclear Science Advisory Committee
Marriott Crystal Gateway Hotel
Arlington, Virginia
June 15, 2005

Participants:
Rick Casten, Chairman
Richardo Alarcon
Ani Aprahamian
Cornelis W. de Jager
David Dean
Sturart Freedman
Alejandro Garcia
Donald Geesaman
Thomas Glasmacher
Roy Lacey
June Matthews
Alice Mignerey
David Morrissey
Guy Savard
William Zajc

Presenters in Order of Appearance:
Richard Casten
Brad Keister
Dennis Kovar
Robert Tribble

Minutes of the June 15, 2005 NSAC Meeting:

The agenda for this meeting is appended at the end of the document. The Nuclear Science Advisory Committee (NSAC) meeting start, initially scheduled for 8:30 a.m., was moved to 8:50 a.m. to accommodate unexpected local traffic delays for some officials.

Introduction: Professor Rick Casten (Yale), chair of the Nuclear Science Advisory Committee (NSAC), opened the meeting with a welcome and brief comment that the major item for the meeting was presentation and discussion of the draft report to NSAC on "Guidance for Implementing the 2002 Long Range Plan." Professor Robert Tribble (Texas A&M), chair of the NSAC subcommittee charged with the task of providing the guidance, will present the draft report. Before Tribble's presentation, Casten reminded the NSAC membership about conflict of interest rules. Those with any potential conflicts would not participate in the direct discussion of the report, but were free to provide comments later during the 'public comments' section of the meeting. The representatives of the Division of Nuclear Physics (DNP) and the American Chemical Society (ACS) on NSAC were also excluded from voting.

Agency Presentations: Dr. Brad Keister, Program Director for Nuclear Physics reported on activities at the National Science Foundation (NSF). While there was no major news to report since the March 2005 NSAC meeting, Dr. Keister indicated that the Major Research Instruments (MRI) were under review at the NSF. Dr. Dennis Kovar, Associate Director for Nuclear Physics (NP) at the Department of Energy's (DOE) Office of Science, discussed the DOE Nuclear Physics Program for FY 2005, FY 2006 budget request and FY 2007 budget process, and status of positions in the NP Office. FY 2005 funding at $404.8M (+3.9% over FY 2004) allows DOE NP accelerator facilities to run at ~83% of optimum utilization. Research support is up +2.6%, with HIGS (TUNL), TAMU, GRETINA and FNPB upgrades underway. The FY 2006 NP request ($370.7M) represents a -8.4% reduction compared to FY 2005—indicating significant impacts for scientific productivity for both facility operations and the research community. However, the FY 2006 request does provide for investments in forefront scientific capabilities, both continuing (GRETINA and FNPB) and new (STAR TOF and RHIC EBIS). Further, R&D for proposed CEBAF 12 GeV Upgrade and RIA projects is included. The DOE is presently in the midst of its FY 2007 budget process and it is too early to know what the out-year projections for NP will be. Dr. Kovar stated that the NSAC report, to be presented at this meeting, will be one of many important inputs to the DOE budget process. The timing of the report was established for its use in the Office of Science (SC) and DOE decision process. Next, NSAC was informed that the National Academy Board of Physics and Astronomy would be conducting a study of RIA. This scientific assessment, requested by the Office of Management and Budget (OMB), is to be available by October 2006. A brief review of the schedule of twelve reviews to be carried out for the NP Office between July 2005 and the end of the calendar year was also presented—indicating both the intensity and level of importance such reviews are to the NP Office. Dr. Kovar finished his presentation with comments on the present status of the NP Office—both the Physics Research Division and Facility and Project Management

Division Directorships are in the process of selection, as is the Program Manager position for the Advanced Technology Research and Development Program.

Both agency presentations mentioned that the FY 2006 Congressional Appropriations process to-date indicated strong support for increased funding for basic scientific research.

Presentation of Subcommittee Report: To introduce this section the NSAC chair began by thanking the subcommittee for the thoughtful work that they collectively put into the report, under the tough constraints imposed by the charge. He further stated that the committee meetings and discussions were held in a very collegial and professional manner. The presentation was then turned over to the subcommittee chair, Professor Robert Tribble. The website for the complete subcommittee report will be indicated later in these minutes. What is shown below provides a sense of the presentation of the draft report, and a summary of subsequent discussions which served to clarify the report, and answer questions or comments on the part of NSAC.

Tribble's presentation began by discussing the charge to NSAC that the subcommittee responded to. Elements of the charge included:

- Examination of existing research capabilities and scientific efforts;
- Assess their role and potential for scientific advancement in international context;
- Determine time and resources (facilities, researchers, R&D and capital investments) needed to achieve the planned programs;
- Identify and evaluate the scientific opportunities and options that can be pursued at different funding levels for mounting a world-class, productive national nuclear science program;
- Report should provide recommendations on the priorities for an optimized DOE nuclear science program over the five year period (FY 2007-2011), under the following funding scenarios:

    - Flat-flat funding at $370.4M, actual dollars;
    - Constant effort funding (starting with $370.4M in FY 2006), inflated dollars;
    - Funding levels needed to restore research capabilities and scientific programs to mount an optimized program and to address the scientific opportunities identified in the 2002 Long Range Plan (LRP) in order of their priority.

The subcommittee activities were described; these included: conference calls, the scheduled meeting in Bethesda, Maryland (April 3-5, 2005) to receive presentations on CEBAF, RHIC, Nuclear Theory Center, and overviews of nuclear theory, nuclear structure, nuclear astrophysics, neutrons and fundamental interactions, and neutrinos and double beta-decay; and the Chicago meeting (May 4-6, 2005) to develop the science sections and recommendations for the report. All of the subcommittee interactions were connected by a very large number of emails.

The next step in the presentation outlined recent nuclear physics highlights, including: neutrino mass and flavor mixing, new form of high density, high temperature matter (perfect fluid), precision measurements of magnetization, charge and strangeness currents in nucleons, ^{6}He radius measurements via laser trapping, half-life of ^{78}Ni half-life important to r-process path, $^{14}N(p,\gamma)^{15}O$ stellar reaction rate and tera-scale computing for QCD on the lattice. Many more physics highlights can be found in the committee report. This outstanding science is seen as coming from the present frontiers of nuclear physics: quantum chromodynamics (QCD), physics of nuclei and astrophysics and fundamental symmetries and neutrinos. From the subcommittee's view, the mission statement for nuclear physics, broadly stated in its report, is**: Explain the origin, evolution, and structure of the baryonic matter of the universe—the matter that makes up stars, planets, and human life itself.**

Considerable time was spent in presenting the scientific findings of the subcommittee. Their eight findings are indicated below:

- The recent discovery of a new form of matter at RHIC with temperatures characteristic of the earliest moments of the universe presents a dramatic science opportunity demanding further exploration. RHIC's unique capabilities will also allow it to resolve the role of gluons in the spin of the proton.

- A QCD-driven search for exotic particles, the imaging of quarks inside protons, and precise measurements sensitive to new physics are core components of the Jefferson Lab 12-GeV Upgrade program. This upgrade should proceed as quickly as possible.

- RIA remains the highest priority of our field for major new construction. It was noted that the subcommittee continues to be guided by the 2002 LRP, following the recommendation that RIA can proceed only with a significant influx of new funding.

- Nuclear physics has produced dramatic advances in neutrino science, with the demonstration of flavor change, mass and oscillations. These discoveries open enormous opportunities in neutrino science.

- Nuclear physics initiatives in fundamental symmetry tests will open a window into physics beyond the standard model. These efforts test the very foundation of subatomic physics and must be pursued vigorously.

- The implementation of the recommendation of the NSAC Theory Report for increased investments in manpower and computing infrastructure is critical to the overall success of the nuclear science program.

- A major component of the U.S. nuclear physics program is the newly upgraded NSF facility—the NSCL. The subcommittee reaffirms the 2002 LRP priority given to the operation of the NSCL.

- A multipurpose deep underground laboratory, an NSF initiative, remains a high priority for nuclear physics research in the areas of neutrino physics and nuclear astrophysics.

The next level of presentation consisted of the subcommittee's response to the following five funding scenarios:

- Near constant effort (NCE)-LRP level—restore program to a near constant level of effort per the LRP recommendation, but with no RIA construction.

    - This scenario includes: improved support for research, operates existing facilities, increased support of theory, upgrades CEBAF and detector upgrades at RHIC, starts new major items of equipment (MIEs) for neutrino-science and fundamental symmetries, and carries out upgrades at ATLAS and HRIBF. To achieve this level, substantial funding increases above present projections would be required in FY 2007 and out-years, with no funds identified for RIA.

- FY 2007 funding at ~$25M below NCE LRP and then constant level of effort.

- FY 2007 funding at ~$45M below NCE LRP and then constant level of effort.

    - In both these scenarios, preserve funds for new MIEs for neutrinos and fundamental symmetries, increased support for theory, funds for ATLAS and HRIBF upgrades and funds for RIA R&D.
    - At ~$25M below NCE LRP, run program and carry out upgrades. For RHIC operations and detector upgrades uses the 'Barnes Report on Heavy Ions' as guide. Leverage running time at CEBAF to carry out 12-GeV Upgrade, which may need 'staged approach.'
    - At ~$45M below NCE LRP, run program and carry out upgrades. But funding for RHIC operations and detectors upgrades reduced. Carry out CEBAF Upgrade but with very little 6 GeV running and stretched schedule to completion. Upgrades at ATLAS and HRIBF slowed, as are new MIEs.

- Constant effort funding (starting at $370.4M in FY 2006), inflated dollars.

- Flat-flat funding at $370.4M, actual dollars.

    - Both scenarios considered as disastrous by subcommittee.

- Can't sustain RHIC and JLab operations at meaningful levels and have a future program in other areas of nuclear physics—subcommittee separately considered consequences of shutting down RHIC or JLab.

The final portion of the presentation focused on the two scenarios: shut down RHIC, operate and upgrade CEBAF; shut down CEBAF, operate and upgrade RHIC.
The following elements of losses for the science program under the two closure scenarios were presented.

Close RHIC, lose:

- No further investigation of the new state of matter found at RHIC.
- No real understanding of the QCD phase transition in the early universe.
- Only minimal understanding of the gluon contribution to the spin of the proton.
- No understanding of the sea-quark contribution to the spin of the proton.
- No precision study of QCD at truly high gluon densities.

Close CEBAF, lose:

- No tomographic map of the quark and gluon content of the proton.
- No discovery of new exotic particles predicted by lattice QCD.
- No precision tests of the electroweak standard model using polarized electrons.
- No complete view of the strange quark contribution to the EM properties of the proton.
- No understanding of how the properties of protons and neutrons are modified in nuclei.

Under either scenario the subcommittee indicated significant reductions in graduate students would take place and that the field would fall far short of projected workforce needs in the future, a majority needed for other areas of the U.S. R&D portfolio.

Excerpts of the guidance from the subcommittee for the two low budget portions of the charge, involving either closing RHIC or closing CEBAF are summarized below:

- "The subcommittee recognizes that under either scenario, the nation and its foreign partners will suffer a tremendous loss in science and the U.S. will no longer be able to maintain international leadership in at least one of the subfields of nuclear science."

- "Because of the superb science lost in both scenarios, the subcommittee was not able to make a choice based on scientific merit alone."

- "The present budget scenario, however, represents a crisis that would preclude running both large facilities simultaneously and forces an immediate choice while RHIC is still in its initial discovery phase. Based on this additional consideration, the subcommittee, while split in its decision, has a slight preference for the choice that maintains operation at RHIC. If such a budget exercise were to occur in the future, for instance, with the Jefferson Lab 12-GeV Upgrade well underway, a different choice might well be made."

Professor Tribble concluded his formal presentation by listing the subcommittee members, as shown below:

Subcommittee Membership

Ani Aprahamian (Norte Dame)
Peter D. Barnes (LANL)
Richard F. Casten (Yale, ex-officio)
Gordon Cates (Virginia)
Donald Geesaman (ANL)
Charles Glashausser (Rutgers)
Edward Hartouni (LLNL)
David Hertzog (Illinois)
Gail McLaughlin (North Carolina State)
Curtis Meyer (Carnegie Mellon)
Alice Mignerey (Maryland)
Richard Milner (MIT)
Berndt Mueller (Duke)
Witold Nazarewicz (Tennessee)
Michael Ramsey-Musolf (Cal Tech)
Hamish Robertson (Washington)
Bradley Sherrill (Michigan State)
Michael Smith (ORNL)
James Symons (LBNL)
Robert Tribble (Texas A&M, chair)
Steven Vigdor (Indiana)
William Zajc (Columbia)

NOTE: The final subcommittee report can be found on the web at:

http://www.sc.doe.gov/np/nsac/docs/nsac-report-final1_Tribble.pdf

Initial Discussion of Report: After a few minor clarifications regarding the draft report and presentation, discussion and comments on the report were requested by the NSAC chair. Most of the initial discussion related to RIA and the possibility of additional material related to a potential RIA start being incorporated in the final report—particularly in the so-called optimistic budget scenarios. Regarding workforce issues, it was pointed out that a reduction in graduate students will eventually translate to a reduction in the number of nuclear physics faculty positions in U.S. physics departments. Several NSAC members indicated that they were very impressed with the subcommittee report and that the report developed the 'best case' for all scenarios—viewed as a very positive approach. The subcommittee chair indicated that he would discuss NSAC's comments with the subcommittee and send a revised version of the report to NSAC.

Public Comments: Before the lunch break and final discussion of the report by NSAC, it was felt that public comments should be presented—for the benefit of the subcommittee and, particularly for NSAC members. Speakers during this portion were principally from JLab and RHIC, but others were heard. The following is a brief summary of comments made during this part of the NSAC meeting:

All speakers started by thanking the committee for the hard work they put into the report—with several remarking that the document provided solid scientific content that could be used as guidance by the nuclear science community. It was also stated by some that since the report was put together in a relatively short period of time, it did not allow focus on some science—citing such things as strangeness (JLab and J-PARC in the future), limited discussion on the JLab contributions to cold nuclear matter (with mention of the emerging hypernuclear program at JLab), and the program to understand the transition from meson to quark degrees-of-freedom.

Concern was also voiced that the committee and its report could have benefited from more international participation, stressing the international nature (Europe and Japan) of the program at JLab. It was further noted that possible closure of JLab would deeply impact French scientists participating and often leading research programs there.

It was noted that JLab was providing ~25% of the PhDs for the workplace. Additionally it was remarked that the FEL development at JLab provided important connections to Homeland Security, as well as the electronic Navy.

One speaker asked whether the subcommittee incorporated the impact of decommissioning and decontamination (D&D) under the closure scenarios. The response was that the subcommittee was aware of potential impacts of D&D but did not have the time to fully incorporate them into their budgetary analyses—also such impacts have not been fully reviewed by the agencies or others at this juncture.

Another speaker asked whether the RHIC/JLab user communities were asked what would happen to them under closure of either facility. The subcommittee chair indicated that some attention was paid to this matter, but it is complex and the subcommittee did not have the time to do a detailed analysis of the issue.

Several speakers expressed concern that the ‘disaster scenarios’ mentioned in the report could become a divisive element in the community. Others remarked that this was the time for the community to unite and make a strong case for its science to both the Congress and the Administration—and that the science-based portion of the report provided that case.

Final NSAC Discussion of Report: There was further discussion or requests for clarification on specific items in the report by NSAC members—several related to RIA in the context of the report. It was generally agreed that wording regarding a scenario related to funding needed to “optimize the LRP” would be included in the final report.

Before voting on the report, NSAC heard from three early career scientists from Argonne National Laboratory, College of William and Mary and Duke University. They are all users of JLab and stressed the importance of the science that was being done there, as well as its educational impact of graduate students.

After all discussions and questions had been answered, the members of NSAC, present and voting, unanimously voted to accept the Subcommittee Report.

Transmittal Letter: There was a discussion of several draft transmittal letters for the final Subcommittee Report. It was agreed that the NSAC chair would redraft the transmittal letter, making it shorter and with more emphasis on the great science that has been and can be done. An email draft would be circulated to NSAC.

Concluding Remarks: NSAC would be polled via email for the best possible dates in August to have a meeting to hear the draft report from the Neutrino Scientific Assessment Group (NuSAG) on the subject of double-beta decay.

The meeting adjourned at ~2:40 p.m.

These minutes of the Nuclear Science Advisory Committee meeting held at the Marriott Crystal Gateway Hotel, Arlington, Virginia, June 15, 2005, are certified to be accurate representation of what occurred.

Richard F. Casten
Chairman
Nuclear Science Advisory Committee