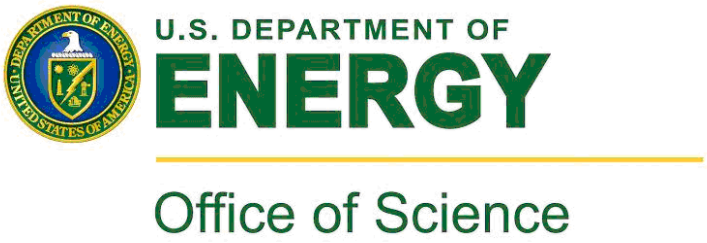

Department of Energy
Office of Nuclear Physics Report

on the

Annual Science and Technology Review

of the

Thomas Jefferson National Accelerator Facility (TJNAF)

July 14-16, 2009

Executive Summary

The Department of Energy (DOE) Office of Nuclear Physics (ONP) held an Annual Science and Technology (S&T) Review of the Thomas Jefferson National Accelerator Facility (TJNAF or JLab) at TJNAF on July 14-16, 2009.

The TJNAF is a DOE facility operated under contract with the Jefferson Science Associates, LLC (JSA). The primary purpose of the review was to evaluate the quality, performance, and significance of the ongoing and planned TJNAF program, in the context of the Nuclear Science Advisory Committee (NSAC) Long Range Plan for Nuclear Science and the national Nuclear Physics Program. The review is also used to assess the activities of TJNAF as required under the JSA / TJNAF Performance-Based Contract with the DOE. The S&T review examines all supported research and development activities carried out by the laboratory as well as the facility operations that support these activities.

The primary goal of TJNAF is to carry out a high quality nuclear physics program that addresses the fundamental questions concerning the internal quark structure of the nucleon and its effect in nuclei. The Continuous Electron Beam Accelerator Facility (CEBAF) produces a high current, highly polarized, electron beam with a 100% duty factor that can be simultaneously delivered to three experimental halls containing extensive instrumentation. TJNAF has five primary areas of technical core competency: superconducting radio frequency (SRF) cavities, intense polarized electron beams, energy recovery linacs (ERLs) and high power free electron lasers (FELs), polarized sources, and cryogenic facilities. The TJNAF is playing a leading role in developing next generation SRF accelerator cavities and it has the only national SRF cavity manufacturing capability. Non-nuclear physics related programs include the 10 kW infrared FEL (1 kW in the ultraviolet) supported by the Department of the Navy. There is effective sharing of expertise between the CEBAF and the FEL that provides clear benefits to both facilities.

The scientific accomplishments of the laboratory over the past year have been significant. The laboratory continues to make substantial progress towards completing the NSAC Hadronic Physics Milestone on nucleon form factors. The new data are of sufficient precision to exclude some models. Precise results have been obtained on the spin structure function of the neutron in the region of low momentum transfers. The Burckhardt – Cottingham sum rule requires that the inelastic contributions equal the negative elastic contributions. The new results are in good agreement with that sum rule. The potential identification of a new N* resonance that could exclude the di-quark binding model for the nucleon was also considered an important advance in baryon spectroscopy.

The theory group continues to achieve at a high level. The group's research topics continue to be in close alignment with the experimental program. Accomplishment highlights this past year include the lattice computation of charmonium hybrid photo-couplings and continued improvements to the lattice N* computation. The lattice gauge

effort is well-integrated with the national and international efforts via the national quantum-chromo dynamics (QCD) collaboration (USQCD), other collaborations, and conferences. However, the group should consider redirecting more effort into science computations.

The Accelerator Operations, Research & Development Division and the Experimental Nuclear Physics Division are congratulated for the excellent accelerator operation performance and the technical support of the experimental program. The CEBAF achieved 6 GeV in beam energy operation this year and 91% for the DOE-defined machine availability. The past year's operation has identified some weaknesses with magnet power supplies, C50 cryomodules, RF cavity performance, vacuum systems and electron gun reliability.

For the first three quarters, Halls A and B are on track to achieve their availability goal of about 90%. Hall C, however, is significantly below this goal, running at about 60% due to the failure of a superconducting magnet which resulted in the cancellation of one experiment. The reviewers considered the handling of the failure to be reasonable and appropriate. However, the laboratory is encouraged to review its policies and procedures to balance the cost versus risk when using users' equipment.

The advancement of major procurements for the 12 GeV CEBAF Upgrade with Recovery Act funds will help ensure the on-time completion of the 12 GeV CEBAF Upgrade project. However, it should be noted that the mitigation of the risks involved with major procurements will require the attention of technical and non-technical staff earlier than originally anticipated and this may place some strain on laboratory resources. The lack of a fully functional 12 GeV prototype cryomodule was of concern to the panel.

Overall, the laboratory has a strong staff with highly productive senior and energetic junior scientists. The operation and Center for Advanced Studies of Accelerators (CASA) staff are being stretched to deal with the rapidly expanding 12 GeV construction project. It is imperative that the laboratory provide adequate staffing for an orderly completion of the most important experiments prior to the termination of 6 GeV operations.

The user community continues to be generally satisfied with the laboratory's support. An increased community involvement to develop the scientific case for the Medium-Energy Electron-Ion Collider (MEIC) is a necessity if the case is to be made prior to the next Long Range Plan (LRP).

The Director and his management team have focused the future scientific mission of the laboratory on efforts that support the mission of DOE and enhance the core competencies of the laboratory. The reviewers noted a positive attitude and enthusiasm of the staff for the new Director. Throughout the review it was difficult to get a good perspective on the staffing needs to complete the 6 GeV project and facilitate the 12 GeV Upgrade and management indicated substantial growth projections for staff in the future once 12 GeV

operations begin. A staffing plan is needed to ensure the appropriateness and reasonableness of laboratory plans.

The laboratory has successfully responded to all previous recommendations.

Contents

Introduction

On July 14-16, 2009, the Office of Science for Nuclear Physics performed an annual Science and Technology (S&T) Review of the Thomas Jefferson National Accelerator Facility (TJNAF or JLab) in Newport News, Virginia. The review committee consisted of seven external consultants: Dr. Berthold Schoch (University of Bonn), Professor Gordon Cates (University of Virginia), Mr. Mark Murphy (Ames Laboratory), Professor Eric Swansson (University of Pittsburgh), Dr. Derek Lowenstein (Brookhaven National Laboratory), Dr. John Marriner (Fermi National Accelerator Laboratory) and Dr. Lewis Keller (Stanford Linear Accelerator Center). Dr. William Bradford Tippens, Program Manager for the Medium Energy Nuclear Physics Program chaired the review. Dr. Jehanne Gillo, Director of the Facilities and Project Management Division was responsible for the review. Dr. Eugene A. Henry, Acting Associate Director of Science for Nuclear Physics; Mr. James Hawkins, Program Manager for Major Initiatives; and Dr. Helmut Marsiske, Program Manager for Nuclear Physics Instrumentation also attended the review.

The primary purpose of the review is to evaluate the quality, performance, and significance of the ongoing and planned TJNAF program, in the context of the Nuclear Science Advisory Committee (NSAC) Long Range Plan for Nuclear Science and the national nuclear physics program. In order to perform the review, each panel member was asked to evaluate and comment on any relevant aspect of the science and technology at the TJNAF, facility operations and strategic planning. Specifically, the focus of the S&T Review was on understanding:

- The quality, productivity, and significance of the laboratory's scientific and technical accomplishments and the merit, feasibility, and impact of its future planned physics program;
- The effectiveness and appropriateness of facility operations and the planning for future facility upgrades in support of the research program;
- The effectiveness of management in strategic planning, developing appropriate core competencies, implementing a prioritized and optimized program, and promoting and implementing a safe work environment;
- The leadership, creativity, and productivity of the facility's scientific and technical staff in carrying out the above activities; and
- The quality and appropriateness of the laboratory's interactions with, and nurturing of, its scientific community.

In addressing these charge elements, the reviewers were also asked to assess the information and status of the Accelerator Improvement Project and General Purpose Plant projects supported by Recovery Act funds and comment on what progress had been made towards addressing action items from the previous S&T Review. There were no recommendations from the previous S&T Review to address, as noted in Appendix A.

The review was based on formal presentations given by the TJNAF staff, reports from the Program Advisory Committee (PAC) and the Users' Group and discussions with TJNAF

staff and users. The first two days were devoted to presentations given by TJNAF staff. These presentations provided an overview and formal response to the charge letter. The third day included a question and answer session with staff management, and panel deliberations. The panel discussed the results of the review with Director Hugh Montgomery, TJNAF staff, and Jefferson Science Associates, LLC (JSA) representatives in a closeout briefing on Friday, July 16, 2009. The panel members were asked to submit their individual evaluations and findings in a "letter report" covering all aspects of the TJNAF program. The executive summary and the accompanying recommendations are based largely on the information contained in these letter reports. A copy of the charge letter and the agenda are included in Appendix B and Appendix C, respectively.

DOE Recommendations

- Formulate a plan to mitigate the risks associated with not having produced and tested a full 12 GeV cryomodule, in the context of recent cryomodule performance, and present it at the upcoming Lehman Review of the 12 GeV project.
- Prepare a laboratory staffing plan for all activities extending into the 12 GeV era that also includes the past staffing history since FY 2004. This plan should be submitted to Department of Energy (DOE) Office of Nuclear Physics by October 13, 2009.

Scientific Program

Experimental Program

Findings:

The current 6 GeV program at Thomas Jefferson National Accelerator Facility (TJNAF or Jefferson Lab) is planned to be completed in the next three years before the shutdown for the implementation of the 12 GeV Upgrade Continuous Electron Beam Accelerator Facility (CEBAF) Project. The increase of energy to 12 GeV provides new opportunities in hadron physics.

Recent scientific and technical accomplishments, amongst others, include:
Preliminary results of the ratio F^n_2 / F^p_2 up to x=0.8. Results of the European Muon Collaboration (EMC)-effect have been extracted from measurements on ^{3}He and ^{4}He. The effect is larger for ^{4}He and three body calculations do not explain the ^{3}He data. Progress on the understanding of electromagnetic and electroweak form factors.

The Policy Advisory Committee (PAC) approved 14 additional experiments for the 12 GeV program: the 12 GeV program around the planned base line equipment has been developed further by the new proposals. The PAC approves of the schedule developed by laboratory management for the finishing of the 6 GeV program.

The failure of a polarized target magnet supplied by outside collaborators caused a substantial loss of useable beam in Hall C and the cancellation of one scheduled experiment.

Comments:

The quality, productivity, and significance of the laboratory's scientific and technical accomplishments are outstanding, and they clearly address some of the most central questions facing hadronic physics. It is also worth noting that the panel thought the laboratory's plans for concluding the 6 GeV program were extremely well thought out, and did an excellent job of utilizing the available time and resources.

Preliminary results on the electromagnetic form factors, G_E and G_M, for the proton and neutron, and backward-angle results on the strange form factors from the G0 experiment, now makes it possible to perform flavor separations that largely satisfy Hadronic Physics Milestone #4. The expanding knowledge of the nucleon form factors contributes significantly to the understanding of nucleon structure in terms of quantum chromodynamics (QCD) degrees of freedom. The new data presented are of sufficient precision to exclude some vector dominance and pQCD models, and thus will provide useful insight into our understanding of nucleon structure. There are plans to measure G_E and G_M at 12 GeV with several experiments. The impact of these experiments on discriminating between different models appears to be less significant than the measurement of the electromagnetic form factor ratio, G^p_E/G^p_M, up to $Q^2 = 10$ GeV^2 which will be very useful in separating perturbative, vector meson dominance, and quark

model computations. Thus, the priority concerning funding and scheduling of each of these experiments should be evaluated in light of their individual impact to this field.

Precise results have been obtained on the spin structure function of the neutron in the region of low momentum transfers. The spin structure functions of the nucleon in the resonance region is of particular interest in order to understand the rapid transition from resonance dominated coherent processes to incoherent processes of deep inelastic scattering (DIS) of the constituents. Specifically, the Burckhardt – Cottingham sum rule provides such a connection. That sum rule requires that the inelastic contributions equals the negative elastic contributions. The new results are in good agreement with that sum rule.

A successful run of Deeply Virtual Compton Scattering (DVCS) with three particles in the final state (e, p, $\gamma(\pi 0)$} has been successfully finished. The data set covers a broad range of x_B and Q^2 and thus allows a good test for extracting the General Parton Distributions.

On the N* program, continued progress is being made on analyzing existing data, including coupled-channel analysis within the Excited Baryon Analysis Center (EBAC). Data of the kaon photo production have been analysed and yield total and differential cross sections for Λ and Σ hyperons in the final state. The data are of high quality and provide another corner stone for the N* program. Among results that were discussed was the assignment of a P_{13} resonance for $N^*(1900)$. If the existence of this resonance is confirmed, it would argue against the so-called "diquark" models of binding the three quarks inside the nucleon. During the next three years, this experimental program enters into a decisive phase by using polarized proton and neutron targets (FROST and HDIce)**.** The result of these experiments should provide a significant advance in our knowledge by constraining the relevant degrees of freedom involved in binding quarks within baryons.

The transition of the allocation of beam time from a situation of five years of backlog to finishing up the experimental program for the 6 GeV beam within three years has been accomplished in a transparent way including the PAC and extended discussions with the users.

Two major experiments planned for the next three years, Q_{weak} and Parity Violating e-scattering on Pb, promise to make a major impact in particle physics and nuclear physics, respectively. Q_{weak} constrains new physics beyond two TeV, and the Pb n- radius experiment provides a fundamental check on nuclear theory by the discrimination of the various calculations of the equation of state. Both the Q_{weak} and PV experiments have technical and schedule risks as they require beam and target parameters and e-polarization measurements that have yet to be demonstrated.

The development of new instrumentation allowing new types of experiments continues. The BONUS set-up yields what one has hoped for and paves the way for experiments on "free" neutrons. The installation of HDice, a very difficult installation, started and offers unique measurements on polarized neutrons.

The plans for completing the 6 GeV program are appropriately aggressive and will require sufficient resources to complete, as well as the continued vigilance of laboratory management to ensure that the highest priority experiments are completed successfully.

The loss of beam time in Hall C due to the failure of a superconducting magnet is unfortunate and it appears that the lab took proper precautions in testing and installing the magnet prior to running the experiment. The failure appears to have been unpredictable and therefore could not have been mitigated prior to the run. The laboratory is encouraged to review its policies and procedures for handling outside experimental equipment to balance the cost versus risk when using users' equipment.

Recommendations:

- None

Theoretical Program

Findings:

The theory group presented their recent research on the N* spectrum, hybrid meson photo-couplings, Generalized Parton Distribution Functions (GPD) phenomenology, coupled channel model development, the pion form factor, higher twist effects in the G-2 structure function.

The lattice gauge theory group has performed computations on the N* spectrum, octet baryon axial couplings, anisotropic clover gauge configurations and progress at understanding few-body physics. The JLab lattice group does not see evidence of multi-hadron states in its N* computations.

The Excited Baryon Analysis Center (EBAC) continues its efforts to develop a coupled channel approach for analyzing meson electro- and photo-production data.

Comments:

The theory group continues to achieve at a high level. The efforts expended in undergraduate and teacher training are commendable. The group's research topics are in close alignment with the experimental program. Accomplishment highlights of the theory group this past year are the computation of charmonium hybrid photo-couplings on the lattice and continued improvements to the lattice N* computation. The Lattice gauge theory group is continuing a strong research program. Its effort is well integrated with the national and international efforts via the national LQCD Collaboration (USQCD), other collaborations, and conferences. It continues to offer substantial support to the USQCD initiative. The group should consider redirecting more effort into science computations. The new joint appointment to the group should greatly assist in achieving this.

The lack of evidence for multi-hadron states raises the possibility that sea quark effects are not completely incorporated into the computation. The lattice group is encouraged to carefully investigate the issues associated with mixing valence and continuum states in their computation.

GlueX will be collecting large amounts of photo-production data once the upgrade is complete. The theory group is putting some effort into computing hybrid meson photo-coupling with lattice gauge theory, which is commendable. The theory group also should consider initiating a research program in the phenomenology of meson photo-production.

The EBAC coupled-channel effort, while commendable and necessary, is a demanding task that is challenged with intrinsic ambiguities that makes it difficult to obtain community endorsement. In the future, EBAC should redouble their efforts to coordinate their approach with other international efforts and should attempt to establish standards by which coupled channel models should be compared to experiment.

Recommendations:

- None

Facility Operations and Planning for Future Facility Upgrades

Facility Operations

Findings:

The CEBAF accelerator operations are the responsibility of the Accelerator Operations Research and Development Division, and experimental support is the responsibility of the Experimental Nuclear Physics Division. Both are responsible for the 24/7 operations. The Fiscal Year (FY) 2009 run will provide 34 weeks of high-energy operations with beam delivery to all 3 halls. The CEBAF attained 6 GeV with an average multiplicity of 2.6 and the DOE defined beam availability of 91%.

The major sources of lost time (>1%) in FY 2009 were due to magnet power supplies that are showing their age (some are the original 4 GeV supplies), superconducting radio frequency (SRF) including the failure of the Renascence cryomodule, radio frequency (RF), cryogenics and vacuum. The November 2008 turn-on period took roughly four times longer than usual to achieve the availability goal for an entire week, ~ 35 days at 5 GeV.

In FY 2008, the laboratory experienced an unexpected 40% increase in the fuel surcharge which increased the cost of operations. This increased fuel charge is no longer expected in FY 2009.

The load lock electron gun continues to suffer from a field emission issue resulting in reduced cathode lifetime.

Planning for the transition from the 12 GeV Project to operations has just begun.

Comments:

The Accelerator Operations, Research & Development Division and the Experimental Nuclear Physics Division are congratulated for the excellent accelerator operation performance and the technical support of the experimental program. The availability metric is well above the required DOE performance goal. The machine has recovered from the aftermath of Hurricane Isabelle, and has finally reached 6 GeV.

The past year's operation has identified weaknesses with magnet power supplies, C50 cryomodules, RF cavity performance, vacuum systems and electron gun reliability. The impact is immediate for the present operations.

The ongoing 6 GeV operation staff and the Center for Advanced Studies of Accelerators (CASA) are being faced with a demand to shift personnel to the rapidly expanding 12 GeV construction project. It is imperative that JLab provides adequate staffing for an orderly completion of the most important experiments prior to the termination of 6 GeV operations.

It will be important for the accelerator physicists to take an important role in the commissioning of the 12 GeV project. Accelerator physicists should have a formal role in the commissioning.

The staffing needs for the various and significant Work for Others (WFO) projects are likely to have an impact on the Nuclear Physics (NP) program.

Of particular concern is the technical failure of the Renascence cryomodule. The cryomodule requires the highest level of technical corrective attention, since this is the key element of the 12 GeV accelerator. The FEL prototype C100 module, which is presently under construction, is one year away from completion.

Recommendations:

- None

Future Directions and Accelerator R&D

Findings:

The laboratory has received stimulus funding that will enable major procurements for the 12 GeV upgrade on an accelerated schedule. The laboratory has completed 2 of 3 of its major Recovery Act procurement milestones, and completion of the third is expected presently.

The cavities for the 12 GeV Upgrade have been tested, but not in the configuration of a full cryomodule.

The SRF research and development (R&D) has progressed on many fronts including the nearly complete cryomodule refurbishment program, the International Linear Collider (ILC) R&D program, and the fundamental understanding of the practical limitations in the gradient and Q-values of superconducting cavities.

A new conceptual design for a staged electron-ion collider that could capitalize on the strengths of Jefferson Lab was presented.

A new vision for the direction for JLab in the era of 4th generation light sources and plan to upgrade the existing Free-Electron Laser has been developed.

Comments:

The SRF R&D program at Jefferson Lab is world-class and is widely viewed as the premier U.S. program in this technology.

The advancement of major procurements for the 12 GeV CEBAF Upgrade with Recovery Act funds should help ensure the on-time completion of the 12 GeV CEBAF Upgrade project. However, it should be noted that the mitigation of the risks involved with major

procurements will require the attention of technical and non-technical staff earlier than originally anticipated and this may place some strain on laboratory resources. The lack of a fully functional 12 GeV prototype cryomodule is a disappointment, especially in view of the presentation that showed that the critical HOM's are a function of the cavity environment.

The vision for JLab as a significant participant in 4th generation light sources would be a shift in emphasis of the lab. The FEL program has been technically innovative and well managed within rather limited resources. The FEL work is a valuable complement to the nuclear physics program.

The scientific case and machine design parameters for a medium energy electron-ion collider (MEIC) are fluid. The new conceptual accelerator design work is a valuable contribution to the discussion. The laboratory is fortunate to have a major, funded construction project, but this fact may limit the options for participating in this effort and in other projects in the pre-proposal stage. It will be important for the laboratory to monitor the situation and to respond appropriately within the resource constraints.

Recommendations:

- Formulate a plan to mitigate the risks associated with not having produced and tested a full 12 GeV cryomodule, in the context of recent cryomodule performance, and present it at the upcoming Lehman Review of the 12 GeV project.

Recovery Act Projects

Findings:

Based on input from the Associate Directors vis-à-vis the ten-year Site Plan, the laboratory identified a suite of "mission critical", "shovel ready", priority General Purpose Plant (GPP) items which could be funded by the American Recovery and Reinvestment Act (ARRA). The laboratory received $10 million of ARRA funds for five GPP projects, all of which they are planning to complete in one calendar year. This is approximately a factor of five more than the expected GPP yearly allocation.

To meet the design, procurement, and construction schedule, the laboratory has hired several personnel for construction safety, procurement, and engineering. A project manager for each of the five ARRA projects has been identified and three of the projects are already out for bid. The remaining two projects are scheduled to be bid in the next month.

The Accelerator Division received an ARRA grant of $2.76 million from the Office of Nuclear Physics to build an 11 GeV RF separator to support 12 GeV capabilities. This investment boosts the nominal accelerator improvement project (AIP) base of $1.2 million. In addition, the Accelerator Division received other ARRA grants from the NP Applications of Nuclear Science and Technology solicitation totaling $2.81 million.

These are five-year collaborative efforts with Old Dominion University. ARRA funds are also provided by the Office of High Energy Physics for $1.95 million in collaboration with the College of William and Mary.

Comments:

The balance of the proposed ARRA GPP projects between experimental and accelerator needs seems appropriate. The ARRA projects are well-defined and appropriate managements systems are in place to ensure that the projects are completed on cost and schedule.

Recommendations:

- None

General Purpose Plant (GPP) Projects

Findings:

The overall laboratory infrastructure vision includes ARRA GPP projects, programmatic GPP and Science Laboratory Infrastructure (SLI) projects. The laboratory has a process in place by which they identify and prioritize programmatic GPP projects. This includes discussion with the scientific and technical staff in the setting of priorities.

Over the years, the laboratory has made infrastructure a priority and increased the investment in programmatic GPP, with a redirection of funds from other parts of their program into GPP.

Comments:

The reviewers endorse the involvement of laboratory scientific and technical staff in the identification and ranking of GPP projects as these investments compete with other laboratory needs. In light of proposed increased investments in GPP, increased communication with DOE NP regarding the justification of these projects is warranted.

The laboratory does not have a formal written procedure describing how to identify and prioritize the GPP projects. A peer review of the laboratory's Mission Readiness procedure is planned in 2010 and the laboratory plans to document the prioritization procedure prior to the review. It would be beneficial to communicate this plan to NP prior to the review.

Recommendations:

- None

Scientific and Technical Staff

Findings:

JLab has approximately 690 Full Time Equivalent (FTE) staff. JLab employees and their students have received important awards in the past year, including American Physical Society (APS) fellow designations, a DOE Presidential Early Career Award for Scientists and Engineers (PECASE) and Outstanding Junior Investigator (OJI) award, and patents.

JLab staff participate in high level committees and boards, including advisory committees, project reviews, and conference organization boards. The Scientific Director chairs the International Conference on High-energy Accelerators (IUPAP) Working Group on the international cooperation in Nuclear Physics. Staff serve on the International Advisory Committees for many conferences, and have been or are involved in the planning of many meetings in 2009.

In the experimental program, 8 Physical Review Letter (PRL) publications have appeared or been accepted since the start of 2009. Approximately 15 publications in other journals appeared in the same time period. The research of the theory group is widely publicized, with 5 letters (Physical Review Letters and Physics Letters), 49 papers in other refereed journals, 36 invited talks in conference proceedings, and 7 contributed papers published since the beginning of 2009. In the accelerator division, there were 15 peer-reviewed articles, 61 conference and workshop proceedings, 3 patents and 2 awards or recognitions.

Members of the theory group serve on advisory panels to major conferences, have an incoming OJI investigator and eight fellows of the APS. Publications in PRL and Physics Letters continue at a pace of approximately 14 per annum, and in other journals at approximately 50 papers per year. The group has assisted in the education of nine graduate students and three undergraduates, helps organize the annual Hampton University Graduate Summer School (HUGS), mentors high school students, and provides vital input to the PAC assessment process.

Comments:

The JLab scientific and technical staffs have maintained a strong rate of publication in recent years. Senior and junior experimental staffs continue to have and gain high visibility in the physics community as exemplified by invited talks and many publications.

The high efficiency in machine and detector operations and many experimental results indicate a highly professional and technically capable experimental staff.

The SRF and cryogenics staffs are internationally recognized and playing leading roles in the development of projects important to the SC mission and abroad. The SRF R&D program at Jefferson Lab is world-class and is widely viewed as the premier U.S. program in this technology. The work of the polarized source group is outstanding.

Recommendations:

- None

Scientific Community

Findings:

The user group has 1300 active members. The users have expressed considerable enthusiasm regarding the results of the search for a new director.

The Chair of PAC 34 emphasized the energy and enthusiasm that was put into the new 12 GeV proposals. The users express satisfaction with the manner in which the lab is dealing with the transition from 6 GeV to 12 GeV. Users are quite happy that the Accelerator plan has been modified to ensure that maximum energy can be delivered to three halls simultaneously. The users have concerns regarding whether the out-year budgets will fund needed capital equipment for approved 6 GeV experiments.

The users are concerned with the laboratory's low level of effort on matters related to EIC. While they understand well that the 12 GeV upgrade has necessarily had much higher priority, they believe that considerable progress needs to be made before the next Long Range Planning exercise.

Led by Zein-Eddine Meziani (the new User's Group body Chair), the user group board hopes to jumpstart more user involvement in EIC-related working groups and workshops.

Comments:

The user community is large, enthusiastic and very productive, as evidenced by new proposals, participation in user group meetings, and the number of publications.

The lab is commended for the effort they have put into engaging the users in navigating the many difficult issues that have naturally come up during the 12 GeV upgrade.

An increased community involvement to develop the scientific case for the MEIC is a necessity if the case is to be made prior to the next Long Range Plan.

Recommendations:

- None

Management

Findings:

Dr. Hugh Montgomery is in his first year as director of the laboratory.

Planning for science includes input from the physics community, advisory committees, laboratory and internal sources. This information is used in developing a scientific plan for the Lab that is included in the Annual Laboratory Plan presented to DOE. The plan is edited to incorporate DOE comments and recommendations and made available to laboratory staff for action.

The planning process for infrastructure is focused on the mission of the Laboratory and prioritizes future infrastructure improvements on closing infrastructure gaps identified in the planning process. Input is obtained from the scientific and technical staff for projects and the prioritization of those projects. This information is rolled into the 10-Year-Site Plan and included in the Annual Laboratory Plan discussed above.

The Laboratory has been successful in attracting ARRA funds for the 12 GeV project, infrastructure improvements and other efforts. The FY 2009 NP Appropriation, combined with the support from other Office of Science (SC) Offices and ARRA funding, essentially doubles the budget of the laboratory relative to FY 2008.

The Laboratory presented staffing projections which propose an increase in staff of approximately 100 FTE's from 2004 leading up to 12 GeV operations.

The Laboratory continues to develop a management system to enhance the operation of the lab and provide public access to the work breakdown structure (WBS)-based laboratory management system. This management system integrates many of the business and operations databases into one reporting system. Management continues to pursue processes to improve efficiency and reduce costs.

The reported Total Reportable Cases (TRC) (0.18) and Days Away, Restricted or Transferred (DART) (0.0) statistics are better than the DOE goal and the Lab has appointed a new safety officer.

Comments:

The panel noted a positive attitude and enthusiasm of the laboratory staff for the new Director. The planning process for scientific direction seems robust and inclusive of the scientific community. It is multi-dimensional and includes input from the physics community, users and staff. The Director and his management team have focused the future scientific mission of the Laboratory on efforts that support the mission of DOE and enhance the core competencies of the Lab.

The ARRA funds will accelerate the facilities modernization process and upgrade the site for future research. A concern exists due to the added pressure this puts on the facilities staff for planning design and project management.

The Laboratory's move to a WBS structure has been a real cultural change for the laboratory staff. The WBS process has been painful for some but has brought a level of transparency, accountability and responsibility to various levels of management. The web-based management system adds to the assurance capabilities of management and the oversight capabilities of the contractor and DOE.

The Laboratory has met more than 25% of its energy reduction goals. It is moving toward implementing quality processes and it has initiated a project management training process to help investigators manage costs and risks.

Throughout the presentations it was difficult to get a good perspective on the staffing needs to complete the 6 GeV project and facilitate the 12 GeV Upgrade. It is important that the staff understand what the top priorities are and where the resources should be focused first. In addition, the laboratory management's staffing projections increase substantially in the outyears leading to 12 GeV operations. A staffing plan is very important to make sure the laboratory plans are appropriate and reasonable.

The significant increase in funding received in FY 2009 and subsequent level and diversity of activities will present a management challenge in ensuring that the priorities of the laboratory remain intact and that commitments are met.

Recommendations:

- Prepare a laboratory staffing plan for all activities extending into the 12 GeV era that also includes the past staffing history since FY 2004. This plan should be submitted to DOE Office of Nuclear Physics by October 13, 2009.

Appendix A: Action Tracking from the 2008 S&T Review

Item	Recommendation/Action	Response by Thomas Jefferson National Accelerator Facility	DOE Comment
1	None	Not Applicable	

Appendix B: Charge Memorandum

Thank you for agreeing to participate as a panel member for the annual Science and Technology (S&T) Review of the Thomas Jefferson National Accelerator Facility (TJNAF) that will take place at TJNAF on July 14-16, 2009. A list of the members of the review panel and review participants is enclosed.

The TJNAF research program, based around the Continuous Electron Beam Accelerator Facility (CEBAF), plays a major role in the Nation's nuclear physics program. As the primary sponsor of U.S. nuclear physics research and the operations of TJNAF, it is important for the Office of Nuclear Physics to understand the progress and future potential of the research program, the effectiveness of its operations, and whether resources and planning are being directed optimally to achieve the scientific goals of the Nation's nuclear physics program.

In carrying out this charge, each panel member is asked to evaluate and comment on:

- The quality, productivity, and significance of the laboratory's scientific and technical accomplishments and the merit, feasibility, and impact of its future planned physics program;
- The effectiveness and appropriateness of facility operations and the planning for future facility upgrades in support of the research program;
- The effectiveness of management in strategic planning, developing appropriate core competencies, implementing a prioritized and optimized program, and promoting and implementing a safe work environment;
- The leadership, creativity, and productivity of the facility's scientific and technical staff in carrying out the above activities; and
- The quality and appropriateness of the laboratory's interactions with, and nurturing of, its scientific community.

You will all be asked to assess the information and status of the Accelerator Improvement Project and General Purpose Plant projects supported by Recovery Act funds. The review should also comment on what progress has been made towards addressing action items from the previous Science and Technology Review.

The first two days will consist of presentations by the laboratory, and executive sessions. The third morning will be used for an executive session and preliminary report writing; a brief close-out will take place in the early afternoon. Preliminary findings, comments, and recommendations will be presented at the close-out.

You will be asked to write individual "letter reports" on your findings. Your "letter report" will be held in strictest confidence, so please be candid in your written remarks. The review will be chaired by Dr. William B. Tippens, Program Manager for Medium Energy Nuclear Physics, Office of Nuclear Physics. We will accumulate your "letter reports" and compose a summary report based on the information in the letters. The "letter reports" will be due at DOE two weeks after the conclusion of the review.

An agenda and background material, as well as travel and housing information, will be sent to you directly from TJNAF. The laboratory will make word processing and secretarial assistance available during the review. If you have any questions about the review, please contact me at (301) 903-1455, or Email: Jehanne.Simon-Gillo@science.doe.gov or Dr. William B. Tippens at (301) 903-3904, or E-mail: Brad.Tippens@science.doe.gov. For logistics questions, contact Susan Brown at TJNAF at (757) 269-7668 or E-mail: sbrown@jlab.org.

I greatly appreciate your willingness to assist us in this review. This is a very important process, and it helps to insure the highest quality scientific program at TJNAF. I look forward to a very informative and stimulating visit.

Sincerely,

Jehanne Gillo
Director
Facilities and Project Management Division
Office of Nuclear Physics

Enclosure

Appendix C: Agenda

Science & Technology Review
Thomas Jefferson National Accelerator Facility
July 14th – 16th, 2009

Tuesday July 14th (F113)

8:00	Executive Session/Continental Breakfast	
9:00	DOE Introduction	B. Tippens
9:05	JSA Welcome	J. Draayer
9:15	Laboratory Overview	H. Montgomery
9:30	Scientific Overview	A. Thomas
10:15	Experimental Nuclear Physics	L. Cardman
11:00	**Break**	
11:30	Accelerator Overview	A. Hutton
12:15	Theoretical Physics	D. Richards
1:00	Lunch (B207)/ Executive Session (F113)	
2:30	The12 GeV Project	C. Rode
3:00	GPP, AIP, SLI and COB Management and Priorities	M. Dallas
3:45	Users Group	R. Gilman
4:05	Break	
4:20	PAC Report	M. Pennington
4:40	Executive Session	
6:30	Reception followed by Dinner	

Wednesday, July 15th (F113)

8:00	Executive Session/Continental Breakfast	
8:30	Report on Experimental Facilities and Operations Metrics	D. Skopik
9:15	Accelerator Operations	A. Freyberger
10:00	FEL and Light Source Developments	G. Neil
10:40	**Break**	

Breakout Session I: Accelerator Operations & Research and Development (L102/104)

11:00	SRF Program	R. Rimmer
11:40	MEIC (ELIC)	G. Krafft
12:10	TEDF – SRF Facilities	K. Royston
12:30	Improvements in Parity Quality Beam	R. Suleiman
12:50	Preparation for HKS	M. Spata
1:00	Lunch (B207)/Executive Session (F113)	

Breakout Session II: Nuclear Physics Research (F113)

11:00	Parton Flavor Decomposition	R. Ent
11:40	Photo- and Electro-production of Hyperons	D. Carman
12:00	Pipeline Electronics for the Next Generation of DAQ at JLab	B. Raydo

12:20	Neutron Charge Form Factor	B. Wojtsekhowski
12:40	GPDs	V. Guzey

1:00 Lunch (B207)/Executive Session (F113)

2:15 Laboratory Tour

3:30 Executive Session (F113)

Thursday July 16th (F113)

8:00 Executive Session
9:00 Discussion with Management if required
12:30 Lunch
2:00 Closeout