REPORT OF THE

UNIVERSITY OF CALIFORNIA PRESIDENT'S COUNCIL

NATIONAL IGNITION FACILITY (NIF)

REVIEW COMMITTEE

NOVEMBER 18, 1999

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INTRODUCTION

The Lawrence Livermore National Laboratory (LLNL) is responsible for constructing and operating the Department of Energy's (DOE) National Ignition Facility (NIF). The Facility is designed to provide experiments in thermonuclear ignition, nuclear weapons effects testing, and high energy density science in support of the nuclear weapons Stockpile Stewardship Program (SSP). On September 3, 1999, DOE Secretary Richardson announced a series of actions to address projected cost overruns and scheduling delays in the NIF construction, about which he had recently learned. A copy of his September 3 press release is attached as Appendix 1.

On October 11, 1999, University of California President Richard Atkinson sent a letter to UC President's Council Chair William Frazer requesting that the Council advise him on the "causes leading to any overruns that may be projected for the NIF project." He also requested that the Council advise him on "steps that the University, the Laboratories, and the President's Council could take to improve project management, communications, and oversight." President Atkinson's specific requests to the Council were:

1. Describe the technical issues involved in the NIF's projected cost and schedule overruns.

2. Assess the effectiveness of the project management structures and processes that were in place to identify and prevent such occurrences.

3. Determine whether Laboratory managers at the various relevant levels notified the appropriate parties of the potential for the cost and schedule overruns in a timely manner.

4. In a more general sense, determine whether there are steps that the managements of the three Laboratories could take to improve project management, reporting, and communication.

5. Recommend the kind and form of management and review mechanisms that the Laboratories and UC should put in place to give the Laboratories, the DOE, the University, and the President's Council a more revealing and timely picture of the status of large projects or programs. In so doing, comment on the review mechanism proposed by the Council to improve the process.

A copy of President Atkinson's charge letter to the Council is attached as Appendix 2.

In response to this request, the President's Council established a NIF Review Committee to address the above questions, derive conclusions, and propose recommendations for consideration by the President's Council. The Committee, whose membership is listed in Appendix 3, was composed of members of the President's Council and its National Security Panel, and outside members with expertise in project management and/or research facility operation.

The Committee met at LLNL on September 19-20, 1999; the meeting agenda is attached as Appendix 4.

There are several review groups that have, to various degrees, on-going responsibility for review of the NIF Project. Among these are the Laser Directorate Advisory Board (LEDAB) and the NIF Council. In addition, indications of NIF cost and schedule overruns have induced several reviews. The Laboratory is conducting a series of technical and managerial reviews, the DOE will be conducting a review through its Secretary of Energy's Advisory Board (SEAB), and the General Accounting Office (GAO) has begun a study commissioned by the House Committees on Science and Armed Services. The Council Committee sought to coordinate as much as is reasonable with these other reviews, both to avoid duplication and to reduce the burden on an already fully-committed NIF staff. Thus, the Committee's investigation consisted of interviewing key people who have or had NIF management responsibility, as well as others who are or were leading reviews of the Project. The Committee did not conduct an *ab initio* technical or managerial review of the Project.

The findings, conclusions, and recommendations of the Committee are presented in this report in a manner directly addressing the tasks outlined in President Atkinson's charge letter.

BACKGROUND

The NIF is designed to focus 192 powerful laser beams onto a target and create a high-temperature environment. Among other applications, that radiation will be used to compress and heat a small capsule of deuterium to ignition and self-sustained fusion burn. As an integral part of the DOE's SSP, and the National Inertial Confinement Fusion (ICF) program, the NIF will be a cornerstone of LLNL's future mission work, with major participation by the United Kingdom, other DOE/Defense Programs laboratories, and the academic community. The NIF project broke ground in 1997, with a Total Estimated Cost (TEC) based on the preliminary design of $1.2 billion. That figure included a 15% contingency, as documented in the Conceptual Design Report; it did not include NIF-related technology development. However, specific NIF related technology development from the broader ICF technology program (the "operating budget program"), was included in the Total Project Cost (TPC).

Major NIF Components

There are three major components of the NIF Project:

1. the conventional facility construction: the laser building, target area, and optics assembly building;

2. the laser and target system infrastructure that holds the laser equipment (including large support structures, vessels, beam path enclosures, cabling and utilities); and

3. the laser equipment, including the laser glass.

Conventional Facility. As of the end of October, the Project reported that the conventional facility was approximately 70% complete and remains on schedule. The currently estimated cost at completion is within 9% of the originally estimated cost and well within the allocated contingency. This work has been done entirely by external contractors, but the Laboratory has been integrally involved in developing many innovative approaches to minimize cost and schedule disruption. The Committee congratulates the NIF staff for their success in delivering this aspect of the endeavor "on time and on budget," particularly given the major unforeseen obstacles that were overcome early in the Project.

Laser and Target System Infrastructure Deployment and Assembly. The laser, optical transport, and diagnostic equipment are mounted in large, temperature-stabilized, and vibration-isolated structures. These structures also include and support the vacuum and gas systems and the integrated computer control and high voltage cable systems. There are stringent technical specifications for cleanliness and alignment. The original Project plan called for these elements to be assembled by an operating contractor directed and augmented by Laboratory staff.

An internal review of the Project, initiated by the Laser Directorate's Associate Director, revealed that the original plan, which relied extensively on Laboratory management and manpower, would be unlikely to succeed in assembling and integrating the highly complex infrastructure within the planned cost and schedule. The cleanliness requirements further enhanced these concerns. After lengthy discussions within the Project about the validity of these findings and possible solutions, a new approach was developed that relies heavily on industrial project management, manufacturing, and assembly expertise. The Laboratory will enlist contractors from the aerospace and semiconductor industries that have experience in the clean assembly of large facilities and high technology equipment. The success in working with outside contractors for the conventional facility construction demonstrated the value of outsourcing and suggests that it should also be a successful strategy for the assembly and integration.

Several additive factors have increased the projected costs of this segment of the project. These include the greater-than-previously-appreciated complexity, the unanticipated need for stringent cleanliness protocols during assembly, and the more complete design packages needed for outside procurement.

Laser Equipment Design. Inadequate operating budget allocations in the early years of the Project led to an underfunding of the technology development activities. As a result, prototyping of some laser subsystems was delayed, causing a 12-18-month delay in the final design of these elements and a corresponding increase in the estimated costs.

Technology

The Project has already successfully solved a number of very difficult technology issues, including the large optical switch and the ability to grow large frequency conversion crystals very rapidly. The Project also successfully demonstrated the engineering feasibility of the high efficiency amplifiers, deformable mirrors, and electrical power systems. Two remaining technology issues involve the large-scale production of laser glass within specification and cost goals and the operational lifetime of the final optics. The Project goal was to scale the production rate of laser glass by a factor of ten while decreasing the unit cost by a factor of three. While both glass vendors have met these goals, the details of the manufacturing process must be refined to meet all the required performance specifications. Both the Project and its reviewers expect that this will be accomplished. The second technological issue is damage to the final optics from the high intensity ultraviolet light to which they will be exposed, which will shorten their lifetime. This damage issue is not a technological "show-stopper," but rather a potentially serious limit on operational cost and efficiency. More work will be needed to better understand the underlying damage phenomenology so that the facility will be able to operate economically at full power.

Mission First Deployment Strategy and Advances in Physics

The Laboratory has worked with the Stockpile Stewardship Program users of the Facility to develop a "Mission First Strategy" for staged activation of the lasers.[‡] A sequencing plan for installation of the laser beam line units has been developed that will allow most experiments to begin on time. The new plan also includes an integrated safety management approach. Advances in target physics suggest that many of the same experiments might now be possible at less than full laser energy, although the degree of technical risk associated with many of these experiments increases as the available energy decreases.

Schedule and Budget

As noted above, the design of some of the laser equipment is 12-18 months behind schedule. The design of the infrastructure has also been delayed by the detailed bid packages that must be developed to prepare for procurement through outside contractors. These schedule slips and the projected significant increases in the cost to assemble the infrastructure cause the Laboratory, based on a very preliminary estimate, to anticipate on the order of 30% growth of the $1.2 billion TEC.

The Laboratory is still working to determine the full scope of the Project with its new approach (see "Moving Forward" below). Certainly, both cost and schedule will be driven by the deployment and operation option selected by the DOE.

Management

The Laboratory operates under a modified matrix system in which the Director vests resources and programmatic responsibility in six Associate Directors, with the workforce and skills obtained from four other Associate Directors. The Director's Office provides oversight and guidance through the Director, two Deputies, the Associate Director for National Security, and the Executive Officer.

Until recently the NIF Project, as were all previous laser construction projects at the Laboratory, was managed by the Laser Directorate, with much of the workforce provided by the Engineering and Chemistry and Materials Science Directorates. Within the Laser Directorate, the Associate Director divided NIF activities among a NIF Project Manager, an ICF Program Leader, and a Laser Science and Technology Leader.

In September 1999 the Laboratory Director transferred responsibility for the NIF Project and the ICF Program from the Laser Directorate to the Director's Office, reporting specifically to the Associate Director for National Security. A new project manager was also selected and the project completely reorganized. Among other changes, the NIF Project organization became

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[‡]The "Mission First Strategy" was first presented to the DOE and the user community in April, 1999. DOE's formal acceptance was not declared until September 27, 1999, in a letter from Gil Weigand to George Miller.

responsible for NIF operations and for participating in the management of the Project's interfaces with the user community.

The Laboratory is administered contractually by the University of California. Programmatically, the NIF Project is overseen by the Oakland Office of the DOE, and by the ICF office within Defense Programs under the Assistant Secretary at DOE Headquarters.

TECHNICAL ISSUES

Committee Charge 1 – *Describe the technical issues involved in the NIF's projected cost and schedule overruns.*

As noted in the Background, the Project reports that the conventional construction of the buildings will be completed on time and on budget within the allocated contingency. This is a notable achievement since some elements of the construction were difficult.

As also noted previously, the Project reports that a number of the technical issues have been solved or are being addressed adequately. These involve amplifier performance, contamination control in the facility, excess water in the glass, and concerns regarding radiation damage to the optics. Again, the Committee did not engage these technical issues, but talked to those who are reviewing them. The technical peer review groups believe that the technical issues can be successfully handled by the Laboratory, and the Committee has no reason to believe otherwise. The Laboratory has an excellent track record of resolving technical issues of this sort.

Instead, the Committee found that the main problems have been a failure to fully appreciate the complexity of the NIF system, some relatively fundamental project management issues, and a contingency inadequate for a Project of this complexity and technical challenge. The extraordinary complexity of the NIF Project is far beyond that previously attempted by the Laser Directorate. It requires extensive systems integration, design management, inventory tracking, and project planning and performance measurement capabilities beyond those that were available within the Laboratory. The Project's and Laser Directorate's management structures and culture were not conducive to identifying or understanding these deficiencies. Those weaknesses were further exacerbated by weaknesses in the DOE project management system, and by the lack of effective project review by the University. Combined, these management failures are the real root cause and will be discussed in the "Management Effectiveness" section below.

Ironically, one of the Laboratory's successes worked against it in guiding the skill sets and capabilities needed to deploy the NIF. The Beamlet, a full-scale set of all the required optical components (apart from the final optics) for one of the NIF's 192 beamlines, was tested in 1994. It demonstrated the required laser performance and was built within the estimated cost. This success gave the Laboratory confidence that it could build the full NIF using its in-house capabilities. However, Beamlet was a technical demonstration only, not an engineering prototype. It certainly did not demonstrate the complexities of building 192 such systems, assembling them in an integrated and maintainable configuration in a tight space, and getting them to work together simultaneously without conflicting interactions.

MANAGEMENT EFFECTIVENESS

Committee Charge 2 – *Assess the effectiveness of the project management structures and processes that were in place to identify and prevent such occurrences.*

As previously stated, management deficiencies, rather than technical problems, are the root cause of the cost and schedule overruns. Since the NIF is a large and complex project that requires new technology and manufacturing development on an unprecedented scale, development and implementation following accepted sound management principles is the most certain route to success. That various aspects of the installation are novel or require further development need not, and should not, compromise an orderly and cost-effective implementation of the work. In general, there was insufficient formality in the NIF project management, including the failure to use all of the managerial tools available, such as risk analysis, earned value management, and cost-to-completion. Quarterly reviews organized by DOE and other reviews initiated by the Laboratory and UC were ineffective in identifying problems in a timely manner. To the credit of the Project, the problems were eventually identified internally.

We note that LLNL management deficiencies should have been identified through proper oversight by the DOE and the University. The National Research Council report, *Improving Project Management in the Department of Energy*,[1] notes several generic deficiencies that, in the case of NIF, essentially guaranteed over-budget cost at the Project's inception. Three illustrative examples are:

- The NIF Project contingency was set at 15%. A contingency that was based on a risk assessment for the Project would have been set at a much higher level (~30%) for such a technologically complex endeavor.

- The baseline (*i.e.*, a set of technical, scope, cost, and schedule parameters that describe the expected capabilities, cost, and duration of a project[1]) was set too early in the design process. It should have been set later when the technical definition and implementation plan were complete.

- Project activities in the TPC, but outside the TEC, suffered shortfalls in funding that negatively affected the Project.

The Committee found the following deficiencies or problems in the Project management to be contributory to the projected NIF cost and schedule overruns.

1. <u>The Laboratory (and in this case the Laser and Engineering Directorates) has a "do-it-yourself" mentality</u>. The staff believed that they had the capability to provide the requisite scientific and technical expertise and did not see the need for extensive additional outside expertise. This independence encouraged a mindset of trying to work around problems by "thinking smarter." While the goal of doing things "smarter, faster, cheaper" is admirable, it can lead to denial and delay in correcting problems if shortcuts are taken that weaken the necessary project management discipline.

2. <u>There was insufficient "technical definition" of the Project at the baseline</u>. Technical definition, while not requiring detailed design, should include all conceptual definitions and design, specification of all supporting facilities and requirements, statements of expected performance, specification of major equipment, layouts, standard detailed

design specifications and codes, safety and environmental controls, *etc.* If part of the facility requires further development before the "technical definition," then those aspects should be isolated and phased into the total program on a scheduled basis. The use of the basis management tool of "integrated scheduling" would have allowed a balanced attack on risk items.

3. There was an insufficient "implementation plan." The implementation plan is the process of, and mechanism for, thinking through how the work will be done before its actual execution. This process requires evaluation of all the major steps needed to carry out the work (*e.g.*, technical development plans, contracting plans) and the necessary resources (*e.g.*, management, organizational structure, people, skill sets, time, and money). The implementation plan includes a control schedule, cost estimates, and a plan to manage changes in a disciplined fashion. It defines project organization, including the roles and responsibilities of all the involved organizations and key individuals, communication lines, technical or integrating committees, oversight boards, reporting requirements, etc. The use of a more comprehensive implementation plan simplifies the reporting function, enabling a transparent view of the Project status beyond simply reporting spending.

4. The organization structure separated the R&D and design functions. In fact, the separation of the ICF Program and the NIF Project created resource problems (both money and people) since the two did not share common priorities. Specifically, there were shortfalls in funding R&D, which cascaded into design delays with significant cost implications. Although the ICF Program and NIF Project were placed under a single organization in early 1997 to deal better with these integration and priority issues, this is another example where a fully integrated schedule would have been quite useful.

5. The Project suffered from a lack of effective system integration. The Project Management, as noted, did not have experience with projects of NIF's size and complexity, and, consequently, did not fully appreciate the need for a strong, systems engineering and integration capability and function. What system engineering and integration existed was too little, too diffuse, and too *ad hoc*. An important example was the insufficient appreciation of the difficulty of integrating all the lasers and their infrastructures to fit within a tightly constrained building while preserving maintenance accessibility over the long-term operation of the facility. As a result, the building was scaled back to reduce its cost without understanding the impact on the rest of the Project.

6. Management was inappropriate for the size and complexity of the undertaking. In its 1999 input to the Laser Directorate Science and Technology Assessment Report, the NIF Council noted that the management work breakdown structure was only 7.5% of the NIF's TEC, which is remarkably low for such a project. While the NIF Council acknowledged that the management team had been successful to date, it also noted that the hardest part of the project, the integration of its components into a functional system, was just beginning and that the management was simply stretched too thin.

7. NIF did not receive the management attention required of such a project at the most senior levels of the Laboratory. Management levels below the Associate Director were not given, or did not feel that they had, the responsibility and budget or management authority necessary to accomplish their tasks. The Engineering Directorate did not have a single point of contact for NIF, despite its importance and the fact that the vast majority of the LLNL staff on the Project were from that Directorate. In addition, the NIF Project Director did not report to the Lasers Associate Director, but to the Deputy. The Director

of a project this large and important should have reported to the Laboratory Director through the Associate Director.

8. Performance measures or other formal means to judge Project progress were inadequate.

9. Project review process was ineffective. None of the relevant management entities, the DOE, the University, nor the Laboratory, received a critical, independent review of the Project after its initiation. Instead, the NIF Council functioned as more of an advisory group rather than as a team of tough outside reviewers. A proper implementation plan would define a routine of regularly scheduled reviews, reports, and a hierarchy of communications.

TIMELY NOTIFICATION

Committee Charge 3 – *Determine whether Laboratory managers at the various relevant levels notified the appropriate parties of the potential for the cost and schedule overruns in a timely manner.*

The Committee's short answer to this question is "No, the appropriate parties were not given timely notification." Problems were identified and discussed internally that might lead to overruns. There were multiple failures at multiple levels that kept appropriate people ignorant of these concerns. Among the causes for the lack of timely communication were the following.

1. There were insufficient mechanisms for communications upward through the chain of command, other than to each person's immediate superiors. This was the situation internal to the Project, Directorate, and Laboratory, and external in communication to the DOE and the University. Therefore, the lines of communication could be easily broken, and the transfer of information up and down the chain of command could be significantly delayed.

2. There was confusion about roles and responsibilities during a transition in project managers, which lasted approximately nine months beginning in January 1999. As a result, there was some question as to who was in charge overall and who was responsible for bringing up which problems to which superiors. There were additional organizational structure issues, including a layer between the NIF Project Manager and the Associate Director, that created confusion regarding responsibilities and group interactions.

3. The Project had a history of solving problems without raising them externally. Among these were the technology breakthroughs described above; the recovery in cost and schedule for the conventional construction following early setbacks; and the utilization of noncommercial entities for some of the optical components (e.g., polarizers and deformable mirrors). Because of these successes, there was a natural inclination to "tough it out" and deal with the matter internally.

4. Because of shortfalls in R&D funding and inadequate tracking tools, the Project had been forced into a situation of "informal austerity," in which there was little receptivity to raising problems that would require additional funds.

5. There was a lack of proactive intrusion into the management of the Project. While the Laboratory has a long history of rigorously challenging *scientific* program leaders, such review was not applied to the management of the NIF Project. It is possible that the Directorate's previous record of scientific and project achievement and success led the rest of the Laboratory, the University, and the DOE toward a complacent attitude.

6. The culture of the Project was such that the airing of problems to the external world was strongly discouraged.

7. The Project, Directorate, and Laboratory leadership did not consider it valuable or appropriate to involve either DOE or the University in the early definition and discussion of the problem. Until the problem and its implications were better understood and options for dealing with it explored, there was a reluctance to simply bring forward bad news.

MOVING FORWARD

Committee Charge 4 – *In a more general sense, determine whether there are steps that the managements at the three Laboratories could take to improve project management, reporting, and communication.*

Committee Charge 5 – *Recommend the kind and form of management and review mechanisms that the Laboratories and UC should put in place to give the Laboratories, the DOE, the University, and the President's Council a more revealing and timely picture of the status of large projects or programs. In so doing, comment on the review mechanisms proposed by the Council to improve the process.*

As detailed above, most of the NIF problems are not technical. The Project faces serious issues because the DOE and the Laboratory violated some basic principles of sound project management. Moreover, neither the Laboratory, the University, nor the DOE had an effective and critical project review process in place. Some of the management issues plaguing NIF will be faced by other major projects at the other DOE laboratories, including LBNL and LANL. Those common problems include the setting of contingencies at unrealistically low levels and the setting of project baselines too early in the design stage.

Since the Committee did not conduct a case history of any other projects, it cannot accurately comment on the presence/absence or success/failure of project management practices for major projects at other Laboratories. However, the following recommendations regarding how the NIF Project should move forward from this point can be applied easily to other such projects since, as we have noted, the NIF problems stem from a lack of sound project management protocols.

1. The roles and responsibilities of the various parties should be clearly defined. It is not within our charge to define the University-Laboratory-DOE relationships. However, the following expectations seem reasonable.

    - The role of the DOE is to set the mission, identify tasks, provide the funds, set the expectations, and then demand accountability.

- The role of the Laboratory is to plan and execute the tasks and to provide the technical advice and expertise needed to do so.

- The role of the University is to provide management oversight, governance, and administrative infrastructure (*e.g.*, personnel policies), and to ensure fiscal accountability.

Whatever is eventually agreed to by the three entities, the respective roles must be clearly defined and understood by all since it would be detrimental to have either the DOE or the University trying to micromanage or second guess project management decisions.

2. <u>The Laboratory Director must take ownership and devote greater attention to the Project</u>. The Committee acknowledges the Director's commitment to the NIF as a cornerstone of the Laboratory and as an integral part of the SSP. However, it urges him to devote a great deal more time and attention to the Project, indeed to "own" it and its problems, until the NIF is successfully completed.

3. <u>The Laboratory should appoint an Associate Director (or equivalent) for the NIF</u>. This must be a person who can devote the necessary time to serve as a champion for NIF as a defined Project in its own right. This should not be the function of the NIF Project Manager, who must devote full attention to getting the Project back on track. The Associate Director (or equivalent) must be the executive-level sponsor of the NIF Project who can, and will, run interference and interact with all the necessary internal and external constituencies to once again get NIF back into a healthy situation and environment.

4. <u>The Project must establish a "surprise-free" environment</u>. The Committee notes that surprise is always perceived as worse than failure and so must be avoided. The following suggestions are offered toward that end:

- Establish a written communication plan and procedures to ensure and enhance communication from both "top down" and "bottom up" directions. This communication must extend to the various relevant levels in the DOE and University. The plan should also allow for communications, as required, around the chain of command.

- The Laboratory Director must establish a critical, intrusive, independent review of the Project. While this review must occur on an on-going basis, the Director must decide how frequently such a review should be conducted based upon Project risk assessment, progress, technical or managerial concerns, etc. To avoid "inspection paralysis," the process must be limited to few, complementary, hard-hitting reviews. The reviews must also cover more than just the technical and/or scientific progress; they must be balanced to include performance/progress by engineering, systems engineering, and industrial partners. Thus, the review must include an independent outside reviewer from industry with experience in managing major projects, as well as University representation. The review report should be disseminated to the NIF Associate Director, the Laboratory Director, and to the University Office of the President.

5. The Project must follow sound project management principles and develop the appropriate documentation necessary for successful development and implementation of a Project of this complexity. The required elements include:

   - appropriate baseline (see "Management Effectiveness" section) for technical scope, cost, and schedule;
   - integrated implementation plan;
   - alignment of the NIF organizational structure with the Project objectives/tasks;
   - plan for managing change that provides control, accountability, and transparency from the baseline;
   - risk analysis and risk mitigation plan;
   - use of established performance measurement systems, including "earned value" or equivalent (e.g., compares the value of work performed to actual costs and to work planned, and relates resource planning to schedules and technical performance requirements[1]) to track performance to cost; and
   - establishment of rigorous performance metrics.

   Although there will be great pressure to move the Project along quickly, the Committee notes that the Project must be given sufficient time to conduct these tasks appropriately and effectively.

IMPROVING PROJECT MANAGEMENT AT THE LABORATORIES

The Committee believes that the preceding measures are necessary for the NIF Project to move forward in a positive and deliberate manner. As mentioned previously, these steps are readily generalized to establish guidelines for effective project management at *any* of the three Laboratories for *any* major project. Quite simply, roles and responsibilities for all parties must be clearly defined, senior management must "own" the project, sound project management principles must be established and adhered to, communication must be encouraged at all levels, and review must be periodic, rigorous, intrusive, and independent.

The Committee was requested to comment on the review mechanism proposed by the President's Council to assess the status of large projects. In particular, the Council has proposed that the Laboratory Directors define those major projects at their Laboratories that are on-going or planned and that need, or will need, special external review. The Council and its Science and Technology (S&T) Panel will work with the Laboratories to assist them in establishing a review mechanism for each major project that fits the description outlined for NIF in the "Moving Forward" section of this report. The Council also intends to establish a subpanel of the S&T Panel that would serve as a second-level review of such projects. That subpanel would consist of people with expertise in project management of large and complex endeavors, and would function much as the S&T Panel does in review of the scientific divisions at the Laboratories. The subpanel would be represented at the Laboratories' project review meetings and would receive the reports from those reviews. It would ensure that the reviews meet the criteria previously outlined, that they are providing the necessary review and critique, and that the Laboratory is being responsive to the recommendations of the group.

The Committee is supportive of this approach as a means to ensure critical, rigorous reviews without requiring additional burdensome layers of review.

CONCLUSION

The NIF Project can be characterized by a number of remarkable achievements that are attributable to the creativity, hard work, and dedication of its staff and management. These accomplishments are to be commended and must not be dismissed or forgotten in the current atmosphere.

However, the Project is now facing potentially serious cost and schedule overruns because of management deficiencies at the Laboratory, the University, and the DOE. Contributors to this situation were the inadequate contingency and the setting of the Project baselines too early in the design phase of the Project. The Committee has outlined a series of measures that it believes to be essential to enable the NIF Project to proceed forward to successful completion of whatever option is chosen. The very importance of NIF, an integral part of the Stockpile Stewardship Program, places its own constraints and pressures on the Project. The Committee recognizes that there is already tremendous pressure for the Project to quickly strengthen the management structure, set a new baseline, bring in industrial help, and move forward on basically the same schedule and cost plan. The Committee believes that the NIF Project MUST be given time to develop a valid and realistic baseline and implementation plan. With these in hand, the Project budget and control schedule would then be properly reviewed, adjusted, and ultimately approved by the DOE and appropriate funding authorities. These steps, adequate financial support, and the implementation of our recommendations would give the Committee confidence that the Laboratory can successfully complete and operate the NIF.

REFERENCE

1. National Research Council. *Improving Project Management in the Department of Energy*. Washington, D.C.: National Academy Press, 1999.