

Transmittal.txt

From: Clark, Casey On Behalf Of Lehman, Daniel
Sent: Monday, June 30, 2003 4:09 PM
To: Staffin, Robin
Cc: Meador, Stephen; Strauss, Bruce; Rosen, Peter; OFallon, John; Byon, Aesook; HEP-TECH; 'luongo@magnet.fsu.edu'; 'minervini@psfc.mit.edu'; 'tor@slac.stanford.edu'; 'saint@slac.stanford.edu'
Subject: DOE Review Report on the LHC Accelerator Research Program

Attached for your consideration and use is the final report of the Department of Energy Review of the U.S. LHC Accelerator Research Program. The review was conducted on June 10-11, 2003 in Rockville, Maryland. If you have any questions, or would like to discuss the report further, please contact Stephen Meador at 301-903-2490.

Regards,
Daniel Lehman

Director
Construction Management
Support Division, SC-81
301-903-4840
daniel.lehman@science.doe.gov

<<0306LARPrpt.doc>>

*Department of Energy
Review Committee Report*

on the

**U.S. LHC
ACCELERATOR
RESEARCH
PROGRAM (LARP)**

June 2003

EXECUTIVE SUMMARY

This report summarizes the conclusions of the review of the proposed LHC Accelerator Research Program conducted on June 10-11, 2003. The program is intended to exploit the technology and experience developed in the current LHC Accelerator Construction Program by teams at three Department of Energy High Energy Physics laboratories. The Committee found the proposed work plan was sound, made good use of the personnel at the three labs, and moved the accelerator technology base of the United States in a positive direction. The committee endorsed the program and recommended funding at the guidance levels consistent with the specific recommendations within this report.

The Committee encouraged the program to broaden participation to include expertise both in the University community and at other laboratories where appropriate. In addition, the Committee suggested that DOE review the progress and plans of the program next year.

Intentionally Blank

CONTENTS

Executive Summary	i
Contents	
1. Summary	1
2. Technical.....	3
2.1 Accelerator Systems.....	3
2.2 Superconducting Magnet R&D.....	6
4. Cost and Schedule.....	11
5. Management.....	13

Appendices

- A. Charge Memorandum
- B. Review Participants
- C. Review Agenda

1. INTRODUCTION

The U.S. Large Hadron Collider (LHC) Accelerator Research Program (LARP) is a follow on activity to the U.S. LHC Accelerator Construction Project. The United States has made a significant financial and intellectual investment in the LHC. It is envisioned that LARP will leverage the domestic technology and science developed and perfected during the LHC construction project, as well as to leverage work performed under the Department of Energy (DOE) base programs in advanced technology R&D. These activities are intended to keep U.S. accelerator scientists expanding the forefront of their technology.

DOE provided the LARP funding guidance (shown in Table 3-1), as well as its expectations for the program. Given this basis, the members of LARP proposed a multi-year program that provides for participation in commissioning both the U.S. supplied accelerator components, as well as the collider itself, design and construction of state of the art beam instrumentation and diagnostics, basic studies in accelerator physics, and technology development and design for upgraded final focus interaction region magnet systems.

A review of the LARP proposal was held June 10-11, 2003 at the Quality Suites Hotel in Rockville, Maryland. The charge to the review committee, members of the committee, and the agenda are listed in Appendices A through C, respectively.

The Committee endorsed the program and recommended funding at the guidance levels consistent with the specific recommendations within this report.

Intentionally Blank

2. TECHNICAL

2.1 Accelerator Systems

2.1.1 Findings and Comments

The LHC, presently under construction, will be one of the largest and most exciting facilities for High Energy Physics (HEP) around the world. Recognizing this, the U.S. HEP program has invested a significant effort, both financial and intellectual, in the LHC. The LHC Accelerator Research Program (LARP) is a proposal to maximize the return from this investment, which is focused on accelerator science. This is done in two ways: 1) develop methods of improving the LHC performance in both the long and short-term, and 2) use the LHC to educate the next generation of leaders in the field of accelerator science.

The LARP proposal consists of two parts: 1) Magnet Development, which focuses on developing high field superconducting magnets that would be needed for a luminosity upgrade, and 2) Accelerator Systems, which focuses on the instrumentation and accelerator physics that is necessary to attain the design luminosity and higher in the LHC. The Accelerator Systems portion of the LARP proposal was presented as three subprograms, however the topics naturally divide into four distinct topics, as will be discussed here: 1) Hardware Commissioning, 2) Instrumentation Development, 3) LHC Beam Commissioning, and 4) LHC IR Upgrade Design and General Accelerator Physics.

Hardware Commissioning

The hardware commissioning is a desirable outgrowth of the LHC Accelerator Construction project. This is a relatively small effort that will benefit both CERN and the participating members of the U.S. community. Although a detailed plan, coordinated with CERN, is still needed, this will probably be straightforward to develop. The travel budget for the activity of \$15 K/FTE seems too small as it will likely involve multiple trips between the U.S. and CERN during the commissioning periods.

Instrumentation Development

High precision instrumentation has always been an essential element of fully realizing the potential performance of a particle accelerator. The LARP instrumentation development program is well matched to the U.S. expertise and can be expected to advance the LHC

commissioning and improve the LHC operations yielding higher average luminosity. The first task of the instrumentation group is the development of the real-time luminosity monitors that can be used to optimize the LHC operation. Assuming that the CERN management chooses the U.S. technology option, the instrumentation group is well positioned to deliver the devices for commissioning although the task scope and the CERN participation needs better definition.

The second instrument is a tune feedback system that is needed to control the tunes, chromaticity, and coupling during the ramp. Similar systems are being developed for RHIC and the Tevatron, however the details of the system design will depend on the detailed beam physics in the LHC. The final solution will need to be optimized using beam in the LHC. This system could be optimized as part of the U.S. program on the LHC commissioning and should be coordinated as such.

Finally, the third instrument makes use of a new concept developed at the Advanced Light Source (ALS) storage ring and will allow detailed measurement of the longitudinal beam distribution. Although not necessary for initial LHC operation, this device will allow optimization of the longitudinal phase space matching and will provide an important diagnostic to monitor the beam evolution. Additional instrumentation development should wait for LHC commissioning to determine the LHC operational needs.

Beam Commissioning

Participating in the LHC beam commissioning is an important opportunity for U.S. accelerator scientists. The program should speed the commissioning of the LHC and it will educate the next generation of U.S. accelerator physicists, which is essential for the U.S. HEP program. To maximize the utility of this opportunity, many participants should be relatively young, at the post doc or junior staff level.

In addition, for this program to be effective, it must be closely coordinated with the CERN management and the other commissioning participants. Coordination of this effort with CERN should begin soon and a detailed management plan is needed. The program will likely require a full-time senior physicist, resident at CERN at least part-time, to direct the younger U.S. participants and negotiate with the CERN management on their behalf. The participants should be encouraged to take responsibility for commissioning activities and these opportunities need to be made available.

Participation in the LHC commissioning is a very exciting opportunity that will attract some of the best members of the U.S. accelerator physics community. The collaboration should consider expanding this program beyond the three participating laboratories. This will limit the drain of personnel from the ongoing U.S. HEP program and will attract new people into the U.S. HEP program. The proposed Toohig Fellowship might be one path to bring in additional collaborators.

IR Design and General Accelerator Physics

The LHC interaction region design and general accelerator physics programs are important for the development of the high luminosity upgrades of LHC, as well as improving the understanding needed to design the next generation of hadron colliders. However, to be useful, this program should be closely coordinated with the CERN management. Many of the proposed accelerator physics topics of investigation are being studied at CERN and the U.S. program should concentrate on the aspects to which it can make unique contributions.

A specific concern is that it seems early to start detailed design work on the IR upgrades. Although guidance is needed for the magnet development programs, detailed work cannot begin until a better understanding is obtained of the magnet limitations and the specific beam physics constraints at the LHC. The later cannot be understood until after the commissioning of the LHC and thus this program seems premature. Instead, this program would seem to be a logical continuation of the commissioning activities.

The Toohig Fellowship program is an excellent idea which should be developed further. The program could support a number of people and would be one path to broadening the collaboration. Funding can come from the existing LARP program.

2.1.2 Recommendations

1. DOE should approve the proposal taking into account these comments and recommendations.
2. DOE should review the detailed work plan for FY 2004 and the planning for FY 2005 by August 2003.
3. Develop a management plan for the beam commissioning studies during FY 2004.

4. The instrumentation and beam commissioning groups should invite participation from outside the three primary laboratories in the LARP collaboration to staff these programs with the best personnel and bring these people into the U.S. HEP program.
5. Develop a mechanism for soliciting, reviewing, and selecting proposals for instrumentation and LHC upgrades.

2.2 Superconducting Magnet Development

2.2.1 Findings

Technical

The U.S./LARP has set very ambitious but most likely achievable goals in advanced magnet technology. These goals include extraordinary challenges of very high magnetic fields in large aperture dipoles and quadrupoles, very high heat loads in a high radiation environment, excellent field quality, large stored energy, and quench protection requirements.

To achieve these goals the U.S./LARP has developed a multi-year R&D program, intended to directly address these technical issues and result in an accelerator-ready design of an IR quadrupole magnet, or dipole magnet, or both, depending upon the LHC upgrade requirements and the rate of technical success as paced by available funding.

The initial program requires identification of essential primary issues. Technology development will incorporate studies using a parametric approach. Magnetization effects of the superconductor are of critical importance and these may need to be accounted for in the design. The use of the high temperature superconductor BSCCO-2212 shows promise but this should not divert attention from the primary conductor material, Nb₃Sn. A variety of topics to be studied include: mechanical structures (various geometries using bladder and key assembly procedures), cable design (high keystone angles, cores, intrastrand resistance), heat transfer geometries, and impregnation techniques.

The program is structured to take full advantage of results from the base magnet technology program but it will be specifically focused on the IR magnet requirements for an LHC luminosity upgrade.

Quadrupole designs based on proposed LHC upgrade scenarios generate a number of R&D questions that need to be addressed in the near future, for example:

1. Single or double bore quads
2. Optimal geometry for large aperture quads
3. Selection of materials
4. Field quality
5. Heat deposition tolerance
6. Non-parallel bores

Selection from these options depends on the operating parameters to be provided by a functional LHC, and therefore has reduced immediacy because some of these requirements will not be determined until much later in the program.

The program includes commissioning of the magnet systems delivered to CERN under the existing U.S./LHC Construction program. The equipment in the construction program is to be delivered to CERN in an acceptance-tested state. The U.S. should participate actively in the commissioning of the hardware delivered during the construction phase of the project. This will provide valuable experience and knowledge of the contributed hardware and machine start-up conditions and it will also enhance international cooperation. The Committee notes the U.S./LARP should provide the required personnel for this activity in a manner that does not compromise the operation of existing U.S. machines or programs.

The U.S. base program for Nb₃Sn strand development has made extraordinary advances in critical current performance, and the U.S./LARP member laboratories have established themselves as the world leaders in development of Nb₃Sn technology for accelerator magnet applications.

The definition of the work program is at the earliest stages of development and will require more extensive definition. A preliminary allocation of the tasks among the collaborating laboratories seems to follow the already established roles taken by the respective laboratories within the base magnet program.

Cost, Schedule, and Management

The project costs have been defined within the limitations of the funding guidance, and are estimated on a level of effort basis. Consideration of the overall project priorities has been

made in the allocations between the accelerator systems and the magnet R&D program. Magnet development costs follow estimates based on personnel loading and M&S costs estimated from prior experience in the base magnet and LHC and other construction programs.

The schedule is guided by the available funding profile and the construction schedule for the LHC base machine. Installation and commissioning activities are integrated with the LHC project schedule. As an R&D program in the earliest stages of definition, there are minimal deliverable milestones defined. The R&D will likely continue beyond the end of the period of this proposal.

The Superconducting Magnet work is defined as a separate task and is further organized into Technology Development, Dipoles, and Quadrupoles. The program leader receives input and advice from the U.S./CERN Committee and the LHC Accelerator Program Advisory Committee. A system of internal reviews, meetings and workshops is being established to report progress, guide the work, share information, and develop plans.

2.2.2 Comments

The Committee feels this is an excellent opportunity for the U.S. to contribute to enhancing the capability of the LHC and in doing so, will firmly confirm the U.S. as the world leader in Nb₃Sn technology applied to accelerator magnets.

Since this program is founded on the basis of a “Virtual National Laboratory”, the project structure and management must ensure that technology transfer among laboratories is performed efficiently. There is some redundancy of technical capabilities at the three laboratories. Considering the limited budget, project management should establish a method for assigning tasks based on qualifications, experience, and economy. Teams by tasks do not have to necessarily be assembled across laboratory boundaries; it is perfectly acceptable that entire activities reside within one laboratory (provided good communication of results), but it is not acceptable for LARP to allow or fund duplication of efforts. In addition, management flexibility is required to allow for reallocation of resources among the tasks and participants in order to be able to respond to changes in program priorities and/or performance. In addition, there is not a clear definition of how a system design organization will be assembled and managed, and how the results of these system design studies will be communicated to the partners to drive individual R&D efforts.

The Committee feels that since this program is primarily an R&D program and still at the earliest stages of development, it could benefit strongly by allowing participation from

universities with active research activities in superconducting accelerator magnet technology. This could help by introducing new ideas, methods and techniques that are critically needed to meet the ambitious technical goals, and it will allow training of young engineers and scientists at the forefront of superconducting magnet technology.

The technical program outlined here is not very detailed as befits the present very early stage and lack of detailed knowledge of the program requirements. The slow funding start of this program can be used to advantage by allowing time during the first two years of the program to perform detailed design and analysis on the various magnet design options, while performing laboratory scale technology R&D. This will also allow time for further definition of the LHC upgrade requirements. A review should be performed after the first year to firmly establish more detailed tasks, goals, milestones, and deliverables.

Noting that most of the review processes defined in this program are internal, DOE should perform yearly technical reviews by external committee members from organizations not directly associated with this program.

The program costs and schedule appear reasonable at this time as based on the available funding and level of effort.

2.2.3 Recommendations

1. DOE should review the program one year after start of funding by an external review committee with the purpose to better define project goals and deliverables based on work accomplished in the first year.
2. DOE should request the LARP team to specifically address early in the program how the magnet design effort will be organized, and create the mechanisms to ensure that these design efforts drive the priorities of the R&D program.
3. Create the review mechanisms, either by DOE or LARP itself, to ensure that technical activities are not duplicated at different laboratories.
4. Define a formal structure by which tasks can be redefined and work (and supporting resources) reallocated among the laboratories based on the most successful research results and changing programmatic priorities.

5. Develop a process by which universities can contribute to this program and be proactive in informing that community about the program needs. This should be done by the end of this calendar year.
6. DOE should review by August 2003 a detailed work plan of activities for FY 2004 that includes the preparation of more definitive work packages for FY 2005 and beyond.
7. DOE should approve this program as proposed taking into account the comments and other recommendations as noted.

3. COST and SCHEDULE

3.1 Findings and Comments

The summary of cost estimates for the period FY 2004-FY 2009 contained in the U.S. LARP proposal is shown in Table 3-1. These estimates are consistent with general funding guidance provided by DOE.

Table 3-1. LARP Cost Estimate Summary (Then-Year, \$K)

	FY04	FY05	FY06	FY07	FY08	FY09
Sub-Program Costs						
Program Management	89	282	675	695	716	737
Accelerator Systems	638	1,823	3,623	4,457	4,098	3,850
Magnet R&D	323	1,395	6,697	5,849	7,193	7,415
Total Program Cost	1,049	3,500	10,995	11,001	12,007	12,002
DOE Funding Guidance	1,050	3,500	11,000	11,000	12,000	12,000

The cost estimates were developed at a “bottoms-up” level for each of the six major technical subsystems identified in the proposed U.S. LARP organizational structure. These “bottoms-up” estimates were then adjusted to meet funding targets established by U.S. LARP management for the subsystems based on input on needs and priorities from its internal and external advisory groups and the general funding guidance from DOE.

The estimate detail is typical of R&D efforts where planning is defined by large scientific goals, initial technology development needs, and level of effort tasks or resource allocation.

A basis for each estimate exists. Reasonable assumptions have been made with respect to labor rates, materials and services, travel, overhead, and G&A. In addition, subsystem-specific scope assumptions are documented in Section 4 of the proposal.

The U.S. LARP program is not a project. Consequently, a master schedule integrating all proposed activities does not exist. While many of the U.S. LARP program elements are defined by level of effort, many activity completion or need dates can be tied to LHC construction, commissioning and operating milestones. This is particularly true in the Accelerator Physics subsystems.

The schedules for the hardware and beam commissioning tasks are determined by the CERN LHC commissioning schedule. R&D on beam instrumentation will lead to working devices at the time of LHC startup or within a year or so thereafter. The magnet R&D program is planned to deliver at least one accelerator-ready design in time for the start of construction of a luminosity upgrade early in the next decade.

Overall, the Committee finds the cost estimates as presented to be sufficiently complete and reasonable considering the nature of the proposed activities and current stage of planning. It is expected during the execution of the proposed plan that the level of detail for the current year and near term activities will be progressively better defined in a typical “rolling wave” approach to program definition and cost estimating.

3.2 Recommendation

1. Maintain a rigorous systematic process across the U.S. LARP program for consistently developing, evaluating, and monitoring cost and schedules estimates used to plan and execute program activities.

4. MANAGEMENT

4.1 Findings and Comments

LARP is not a construction project, but is an R&D program, guided by technical goals, and should be managed accordingly.

The LARP organization defines an internal review process that evaluates the proposed program of work. The LHC Accelerator Program Advisory Committee evaluates the technical merit and compatibility with program goals and the U.S./CERN Committee ensures that the program meets the needs of the LHC. Oversight for the program is provided by the Fermilab Director and by an advisory committee to the director, the LHC Accelerator Program Laboratory Oversight Group (LAPLOG). The LAPLOG consists of the relevant Deputy or Associate Directors of the three participating DOE laboratories. It is critical that practice demonstrates the actual quality of the critique and management oversight.

The procedure for agency review and the requirements for formal reporting have not yet been defined and agreed upon. Through discussions it was learned that the plan is for annual peer reviews requested by the DOE/NSF Joint Oversight Group (JOG), semi-annual status meetings organized by DOE, and written quarterly reports submitted by the LARP program manager to the JOG. These plans appear to be reasonable and should be implemented.

A traditional line management organization is proposed. The relationship between the JOG and the LARP manager is critical and should be defined clearly. An important aspect of this relationship is the level of agency involvement in program decision-making.

The start of the research program overlaps with the completion of the construction project. These separate efforts require continuous management attention to help ensure success. Over the last few months the U.S. LHC Accelerator Construction Project Manager and Acting LARP Program Manager, Jim Strait, has devoted the majority of his time to developing the LARP proposal and must now redirect his efforts to the construction project. There is an obvious need for an additional person to help manage the LARP and the ideal situation would be the creation of a deputy level position.

There was limited evidence of effort to involve universities in the program. Strategies for reaching out to universities should be pursued with the goal of communicating the goals and opportunities of the program. The proposed Toohig fellowships are an excellent idea and should be pursued as one element of an outreach strategy.

An important planning assumption is that all labor, including scientists, will be charged to the program. This is the same approach that was used for the construction project. The argument for this is that support levels and management of the high energy physics base programs at Brookhaven National Laboratory and Lawrence Berkeley National Laboratory are not conducive to assumptions of contributed support of scientific staff.

It will be a challenge for U.S. staff that serve on long duration assignments at CERN to integrate effectively into the CERN organizations. While it is true that the success of these assignments is most highly dependent on the individuals that serve there is probably merit in management attempting to provide some coherence of the U.S. efforts and developing strategies for helping to make these assignments successful from the perspective of CERN, the U.S. program, and of the individuals.

The general multi-year plans were reasonable and appropriate for the program goals defined. The presentations did not include details of the work plan for FY 2004 and a more detailed description of the scope of work for FY 2004 should be developed and submitted to the JOG within the next month.

4.2 Recommendations

1. Proceed with the full implementation of the management structure proposed including formal definitions of the roles and responsibilities of the line organization and the various advisory bodies by the end of this calendar year.
2. Develop additional strategies for increasing outreach with universities and other laboratories by the end of the end of this calendar year.
3. Prepare a description of the scope of work for FY 2004 by July 11, 2003.

APPENDIX A

CHARGE

MEMORANDUM

memorandum

DATE: March 21, 2003
REPLY TO:
ATTN OF: SC-224

SUBJECT: Department of Energy Review of the U.S. LHC Accelerator Research Program, June 2003

TO: Daniel Lehman, Director, Construction Management Support Division, SC-81

I would like to thank you for agreeing to have your office chair the initial review of the U.S. LHC Accelerator Research Program (LARP). We expect a formal proposal from the LARP team in the middle of April 2003. The review should be scheduled for early June 2003. The site of the review will depend on DOE travel policies in effect at that time.

The U.S. LHC Accelerator Project is moving on to completion on schedule. To maintain the momentum as well as the technology generated during the project and to exploit the expertise generated by the project team in the commissioning of the LHC machine including R&D work on accelerator physics and instrumentation, the Department of Energy is planning to support continued R&D activity in this area. Additionally, the CERN team has already indicated technical needs, mainly concerning superconducting magnets, for a first and second round of machine upgrades that would both increase luminosity and machine energy. (T. Taylor, EPAC 2002.) The existing program in superconducting magnet and cable development, accelerator physics, and beam instrumentation at the three participating laboratories presents a strong basis for the work described in the Taylor paper. This program is not intended to replace the present development programs but rather to build upon them.

You are being asked to review the initial plans for this new program and its general direction, the estimates for cost and schedule, the management structure as well as the proposed program. In particular, please address the questions in the attached charge in making your assessment.

Dr. Bruce Strauss of this office, the U.S. LHC Accelerator Project Program Officer, will serve as Executive Secretary to the review committee, and he will serve as point of contact for the Division of High Energy Physics. He can be called upon for assistance with reviewers and agenda and with arrangements for the review at (301) 903-3705 or Bruce.Strauss@science.doe.gov.

I would appreciate it if you could provide a report of your review to me no later than three weeks after the review.

Again, I wish to thank you for agreeing to chair this review. I look forward to receiving your committee's report.

[signed]

John R. O'Fallon
Director
Division of High Energy Physics

I agree with the actions taken in this letter.

[signed]

John W. Lightbody, Jr., Executive Director
Physics Division
Mathematics and Physical Sciences Directorate
National Science Foundation

Attachment

cc:

S. P. Rosen, SC-20
A. Byon-Wagner, SC-223
M. Pripstein, SC-223
B. P. Strauss, SC-224
J. Yeck, FRMI
J. Dehmer, NSF
M. Goldberg, NSF
T. Kirk, BNL
M. Witherell, FNAL
C. Shank, LBNL

LHC Accelerator Research Program Charge to the Review Committee

The LHC Accelerator Research Program (LARP) is being established as the natural following activity to the U.S. LHC Accelerator Construction Project for collaboration in fabrication of LHC machine components. The LARP is to be a U.S. national organization as was the U.S. LHC Accelerator Construction Project, which includes all parties interested in conducting unique, world class research and providing leadership for accelerator R&D in support of the LHC.

The Department of Energy envisions that LARP is an addition to the base funding and programs currently at the national laboratories and universities. It is not intended to replace these activities.

The LARP Organization has developed an initial plan that will be presented to the review committee and that should address both the near term and long term activities. CERN has developed an initial long-range plan for a luminosity upgrade followed by an energy upgrade. A summary of this planning was presented by Dr. Thomas Taylor of CERN at the 2002 European Particle Accelerator Conference and is available at the following website: <http://accelconf.web.cern.ch/AccelConf/e02/PAPERS/MOYGB002.pdf>. Another CERN view of the upgrade scenario was presented by Francisco Ruggiero at the LHC IR Collaboration Meeting at CERN on March 11-12, 2003: <http://lhc-proj-ir-upgrade.web.cern.ch/lhc-proj-IR-upgrade/Francesco-Ruggiero/CERN-Feasibility-Study.pdf>. This was followed by CERN LHC Project Report 626 (**LHC Luminosity and energy upgrade: A Feasibility Study** / Brüning, O S ; et al. CERN-LHC=Project-Report-626; LHC-Project-Report-626. – Geneva: CERN, 1 Dec 2002. – 98p.) that is available on the WEB at <http://doc.cern.ch/archive/electronic/cern/preprints/lhc/lhc-project-report-626.pdf>

The committee is asked to review the proposed technical program in the context of our existing national program, national organizational structure, management, and resource planning with specific attention paid to:

A. Organization

1. Does the proposed organizational structure represent a truly national activity?
2. Is a process provided within the LARP organization for peer reviews and selection of work packages solely on the basis of merit and appropriate match to the LHC needs?
3. Does the national organization structure provide for adequate oversight of U.S. work performed?
4. Is there a formal process provided for coordinating the U.S. activities with the LHC management and has it been used to develop the current technical plan?
5. Is there a management structure in place to successfully implement the proposed technical program?

B. Technical Program

1. Do the proposed technical program activities keep U.S. physicists and engineers at the forefront of accelerator physics and technology? Do these activities leverage the U.S. base program in these areas?
2. Does the technical program proposed by LARP provide an appropriate match between U.S. leadership and unique capabilities in high field-high gradient superconducting magnet R&D and CERN's long and short range need as presented in the Taylor EPAC paper and other sources?
3. Does the technical program proposed by LARP exploit the unique U.S. capabilities in accelerator physics and instrumentation?
4. Was a peer review and selection process used to select the work proposed and was it based on merit of the proposal and a match to LHC needs?

C. Resource Planning

1. Does the schedule proposed for the technical program match the resources, financial and manpower, available to LARP?
2. Is the proposed schedule realistic and does it match well with the CERN schedule?
3. Does the plan as put forward leverage off the current R&D activities of the three national laboratories and potential university partners? It is assumed that this current level of base support will be maintained in addition to LARP.

APPENDIX B

REVIEW

PARTICIPANTS

**Department of Energy Review
of the
U.S. LHC Accelerator Research Program**

REVIEW COMMITTEE PARTICIPANTS

U.S. Department of Energy

Daniel R. Lehman, DOE/SC, Chairperson
Stephen Meador, DOE/SC
Bruce Strauss, DOE/SC

Superconducting Magnet Development

Prof. Cesar A. Luongo, Florida State University
Dr. Joseph Minervini, MIT
Dr. Steve J. StLorant, Consultant

Accelerator Physics and Instrumentation

Dr. Tor Raubenheimer, SLAC

Observers

Aesook Byon, DOE/SC
John O'Fallon, DOE/SC
David Sutter, DOE/SC

APPENDIX C

REVIEW AGENDA

**Department of Energy Review
of the
U.S. LHC Accelerator Research Program**

DRAFT AGENDA

Tuesday, June 10, 2003

- 8:30 pm Committee Executive Session
9:00 am Introduction and Overview J. Strait
9:45 am Break
Accelerator Systems
10:00 am Accelerator Systems Overview..... S. Peggs
10:15 am Hardware commissioning J. Strait
10:30 am Beam Commissioning and Fundamental AP S. Peggs
11:00 am Beam Instrumentation..... J. Byrd
11:30 am Accelerator Systems Cost Estimate S. Peggs
12:00 pm Lunch
LHC Upgrades
1:00 pm LHC Upgrades J. Strait
Superconducting Magnet R&D
1:30 pm Superconducting Magnet R&D Overview S. Gourlay
1:45 pm Quadrupole Model Magnet R&D A. Zlobin
2:05 pm Dipole Model Magnet R&D M. Harrison
2:20 pm Technology development..... S. Gourlay
3:00 pm Coffee Break and Breakout Sessions
4:15 pm Superconducting Magnet R&D Cost Estimate S. Gourlay
4:45 pm Summary and Wrap-up J. Strait
5:00 pm Committee Executive Session

Wednesday, June 11, 2003

- 8:30 am Committee Executive Session Closeout Dry Run
11:00 am Closeout Presentation to U.S. LHC Management
12:00 am Adjourn