



# U.S. LARP Research Program Management Plan

Version 1.6  
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## Submission and Approvals

This Management Plan defines the plans, organization, systems and relevant interfaces for the U.S. LARP collaboration's Research Program for the Large Hadron Collider (LHC) at the European Laboratory for Nuclear Research (CERN). LARP is funded by the U.S. Department of Energy.

### Submitted and Accepted by:

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Stephen G. Peggs  
U.S. LARP Program Leader

---

Stephen Holmes  
Fermilab Associate Director for Accelerators

---

Pier Oddone  
Fermilab Director

---

Thomas Ferbel  
U.S. LHC Program Manager, DOE

---

Moishe Pripstein  
U.S. LHC Associate Program Manager, NSF

---

Bruce Strauss  
U.S. LHC Associate Program Manager for LARP, DOE

---

John R. O'Fallon  
Co-Chair, U.S. LHC Joint Oversight Group  
Department of Energy

---

John W. Lightbody  
Co-Chair, U.S. LHC Joint Oversight Group  
National Science Foundation

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# 1 INTRODUCTION

The U.S. LHC Accelerator Research Program (LARP) is comprised of participants at four U.S. laboratories – BNL, FNAL, LBNL, and SLAC – who collaborate with CERN to understand, develop, and exploit the accelerator science and technology of the Large Hadron Collider [1]. LARP is involved in the commissioning and operation of the Large Hadron Collider (LHC), and in the anticipated upgrades of performance [2, 3, 4]. This Research Program Management Plan (RPMP) sets forth the guiding vision and program goals for LARP. It describes the mechanisms that are in place to organize, manage, review, guide, and monitor the progress of the program.

## 1.1 Mission Statement

The mission of the LARP collaboration is to enable the U.S. accelerator community to take an active and important role in helping to:

- Make more LHC luminosity, earlier
- Develop an upgrade for interaction regions that will provide even more LHC luminosity, later
- Use, develop, and preserve unique U.S. resources and capabilities in accelerator science and technology.

The Research Program does this by supporting beam commissioning, accelerator theory, accelerator instrumentation and diagnostics, and superconducting magnet R&D. LARP works at the frontiers of accelerator science and technology, in order to maintain and improve the capabilities of the U.S. accelerator community. This helps to ensure the effective operation of domestic accelerators, and it positions the U.S. to take a lead role in the development of next-generation high-energy colliders.

## 1.2 The Frontier

In the second decade of this century, the Large Hadron Collider (LHC) will be the most important instrument for both worldwide and U.S. high-energy physics, as well as the most technically advanced collider, providing unique opportunities for research in accelerator science. Recognizing this, the United States government has already made an investment of more than half a billion dollars in the collider and its detectors. About 50% of the U.S. experimental high-energy physics community is expected to perform research at the LHC. Because of the insights it can provide into fundamental particles and their interactions, LARP will exploit and enhance the national investment in the LHC, by providing unique opportunities to work at the frontiers of accelerator science and technology.

In its recent analysis of High-Energy Facilities on the Twenty-Year Road-map of the DOE Office of Science [5], the High Energy Physics Advisory Panel (HEPAP) recommended that three proposed projects were sufficiently compelling to be called Absolutely Central to the future of particle physics. The definition of this category, to quote from the report is:

*“To be considered absolutely central, we require that the intrinsic potential of the science be such as to change our view of the universe. This is an extremely high standard, at the level at which Nobel Prizes are awarded.”*

The three projects are a high-energy  $e^+e^-$  linear collider, the Supernovae/Acceleration Probe (SNAP), and a luminosity upgrade to the LHC. In the opinion of HEPAP, the goals of the LARP program are therefore absolutely central to the future of U.S. High Energy Physics.

## 1.3 Program Guidance and Anticipated Funding

The U.S. Department of Energy and the U.S. National Science Foundation, acting through the Joint Oversight Group, issued guidance for LARP goals in a letter dated November 21 2000:

*“The research program should be planned to make optimal use of the infrastructure and expertise within the participating U.S. National Laboratories and should be worked out with CERN on the basis of mutual interest. The planned research could be expected to include:*

- *Participation in beam commissioning and ongoing optimization of beam parameters;*

- *Beam experiments, including construction of specialized instrumentation, aimed at both improved LHC performance and fundamental beam physics questions;*
- *Design and development of equipment for improvements to the LHC, such as 2nd generation IR quads and advanced instrumentation.*”

Another guidance letter from the Joint Oversight Group, issued in February 5, 2003, adds:

*“The Department of Energy (DOE) anticipates providing significant funding for the U.S. LHC Accelerator research program to enable active participation of the U.S. scientific community in the accelerator physics research program of the LHC machine as foreseen by the international agreement. While this program will maintain and improve the domestic accelerator physics capabilities it must exploit the substantial U.S. investment in the LHC by providing an accelerator physics and technology basis for improvements to that machine.”*

The Guidance defines LARP as a world-class R&D and scientific research program at the frontier of accelerator science and technology. The deliverables of the research should aim to improve U.S. capabilities and not just be products or intellectual contributions that are already available either at laboratories or in the marketplace. Although some fabricated deliverables are envisioned within the LARP program, major deliverables will be funded separately as LHC upgrade projects are proposed and approved following standard procedures.

Fiscal Year	2004	2005	2006	2007	2008	2009	2010	2011
Guidance (\$M)	1.3	3.3	11.0	11.0	12.0	13.0	12.0	12.0

Table 1: Funding guidance from the DOE

Preliminary guidance from the DOE anticipates that, as shown in Table 1, funding will increase rapidly through FY2006, and then be maintained at a level of 11-12 million dollars per year. A consequence of the slow start of the funding profile is LARP’s modest initial program, with only limited ability to make a vigorous start on magnet R&D, and limited contributions to the initial development of beam instrumentation.

LARP support is not a substitute for support through the “base” or “core” program, but rather assumes the continued existence of such programs in a variety of areas. For example, LARP-funded beam instrumentation will be tested at existing U.S. colliders, and LARP magnet R&D requires the continuation of current programs in Nb<sub>3</sub>Sn magnets and materials. In addition, because it may be difficult for scientists and engineers to take on obligations with LARP, in parallel with their responsibilities in ongoing programs, especially since LARP may require extended periods of stay at CERN, it is necessary to add personnel to staffs at DOE laboratories, dedicated to carrying out LARP responsibilities at CERN for beam-related activities, as well as in the U.S., for extensive R&D needed in magnet development. In order to be able to recruit and retain the best-qualified personnel, it is imperative that LARP funding be adequate and stable from year to year.

## 1.4 Program Goals

LARP has definite goals in three areas of interest: high-energy physics, U.S. accelerator science and technology, and international scientific cooperation.

### High-Energy Physics

LARP enhances the physics output of the LHC by making resources available for collaboration with CERN in order to:

- Bring the LHC up to design luminosity quickly, safely and efficiently.
- Continue to improve LHC performance through advances in the understanding and development of new instrumentation.
- Use the LHC effectively as a tool to gain a deeper understanding of accelerator science and technology.

- Extend the life of the LHC as a frontier scientific instrument through a timely upgrade in luminosity.

### **Accelerator Science & Technology**

In parallel with advancing particle physics at the energy frontier, LARP will also assist in developing a new path to better and more effective accelerators by empowering U.S. accelerator scientists and technologists to:

- Keep skills sharp by helping CERN commission the LHC, which is, at best, a once-in-a-decade opportunity.
- Conduct forefront research and development in accelerator physics.
- Advance national capabilities in accelerator science and technology.
- Develop the advanced accelerator technologies needed for next-generation  $e^+e^-$  colliders.
- Prepare U.S. accelerator scientists to design future generations of lepton and hadron colliders.

### **International Scientific Cooperation**

While not a goal of LARP *per se*, an important benefit of extending our collaboration on the LHC is to further advance international cooperation in large science projects in general, and in the construction and exploitation of high-energy accelerators in particular. Accelerators of the future will have to be built and operated on a fully international basis. The deepening of our collaboration with CERN is an important step in building the sort of worldwide interactions that will be required to advance high-energy physics to the next level.

## 2 ORGANIZATION OF LARP

The current organization of LARP management and its oversight structure are shown in Fig. 1. The LARP Program Leader sets the overall direction, manages the finances, and takes the ultimate responsibility for the effective operation of the program. The Program Leader is in constant communication with both the Office of High Energy Physics and with the Fermilab directorate on matters pertaining to administrative, technical and programmatic issues. The status of the program is reported periodically to the DOE-NSF Joint Oversight Group, at the same time that the other major U.S. HEP components of the LHC – ATLAS and CMS – make their reports. Communication with the directorates of the domestic laboratories is provided through the Laboratory Oversight Group. The U.S.-CERN committee meets annually to endorse any current and planned LARP activities, and to discuss upcoming issues. Members of the U.S.-CERN committee from the domestic laboratories form the U.S. Executive Committee, which meets regularly as a steering group. Independent technical review and advice is provided on an *ad hoc* basis by the LARP Advisory Committee, which meets to hear presentations, and to report conclusions to the Program Leader. The Magnet Steering Committee provides a communication channel between the “horizontal” multi-laboratory LARP Magnet R&D task management and the “vertical” magnet infrastructure management at those laboratories. In addition, the U.S. LHC Research Program Office conducts periodic external technical reviews of LARP activities and the direction of the program, as deemed necessary, but at least once every year.

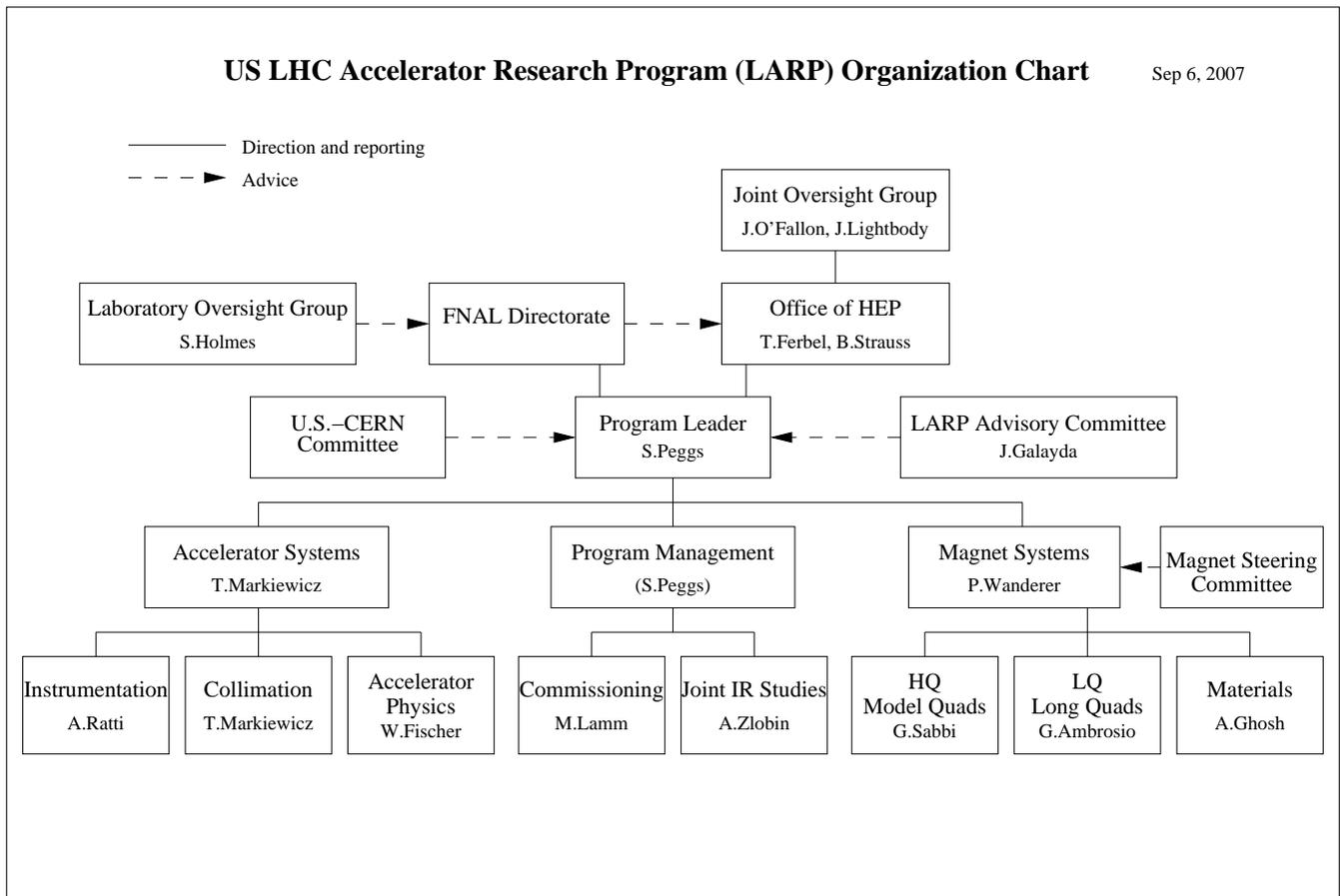


Figure 1: Organization of the LARP advice and direction structure, including advisory committees (September, 2007).

## 2.1 Joint Oversight Group and Office of HEP

The DOE-NSF Joint Oversight Group (JOG) oversees the progress of the three major components of the U.S. High Energy Physics activities at the LHC – ATLAS, CMS, and LARP. It usually meets twice per year. A letter dated November 21, 2000, from JOG co-chairs John O’Fallon and John Lightbody to then Fermilab director Michael Witherell outlines the establishment of LARP. It states that:

*“The International Agreement provides that, beyond the LHC Construction Project, U.S. scientists will participate as full partners in the LHC Research Program. The DOE and the NSF are now considering the elements necessary for successful U.S. participation in the Research Program. In particular, there must be a formal management structure with clear lines of authority to coordinate the planning and implementation of the continuing U.S. role in the accelerator-related aspects of the LHC Research Program. Accordingly we request that Fermilab serve as Host Laboratory for U.S. participation in these aspects of the Research Program, consistent with the International Agreement and its Accelerator Protocol.”*

Routine access to the Office of HEP is provided via the Office of the U.S. LHC Research Program, which monitors and advises on the day-to-day operations and timely issues pertaining to LARP, ATLAS, and CMS.

## 2.2 Host Lab Responsibilities and Authorities

The primary role of Fermilab as Host Laboratory is to provide institutional commitment to the success of the program. In fulfilling this role, Fermilab provides both support of program management and also institutional oversight. Specific responsibilities include:

1. Chairing the Laboratory Oversight Group
2. Provision of administrative support for the Program Leader, including assistance in financial reporting.
3. Advising the DOE Office of High Energy Physics on programmatic and policy issues arising within the program.
4. Developing the LARP Research Program Management Plan (this document) in collaboration with the Program Leader.

## 2.3 Responsibilities and Authorities of the Program Leader

The letter from Robin Staffin (Associate Director for the Office of High Energy Physics of the DOE) and Michael Witherell (then Fermilab Director) appointing the current LARP Program Leader describes the responsibilities and authorities of the position. It states that:

*“As Program Manager (Leader) you will be responsible for providing programmatic coordination and management for all collaborator contributions to LARP. You will represent LARP and its collaborators in interactions with DOE, CERN, and other organizations. You shall provide technical coordination for the collaboration, and coordinate all program activities. You shall be responsible for ensuring that the national program goals are met on schedule and within budget. After consultation with the collaborators, you shall recommend to the DOE the allocation of annually available resources, including contingency funds. Although you will remain a Brookhaven employee in this position, you will also have a joint Guest Appointment at Fermilab. In this position you must maintain a national view and work to achieve the goals of the program without bias. You will be responsible to the Director of Fermilab for administrative matters and to the Associate Director for the Office of High Energy Physics of the DOE for programmatic matters including budget.”*

## 2.4 Laboratory Oversight Group

The Laboratory Oversight Group (LOG) provides a coordinated communication channel between the Program Leader and the directorates of the U.S. DOE laboratories in LARP. This mechanism is invoked when issues of joint policy or strategy arise, or when there is need to discuss LARP access and/or use of specific laboratory infrastructures. Most meetings are by phone, email, or video conference.

*Current membership* (August, 2007):

Stephen D. Holmes (Chair), Fermilab, Associate Director for Accelerators  
Steven Kahn, SLAC, Director of the Particle and Particle Astrophysics Division  
Satoshi Ozaki, BNL, Assistant to the Director for Accelerators  
Jim Siegrist, LBNL, Associate Laboratory Director for General Sciences

## 2.5 U.S. Executive Committee

The U.S. Executive Committee (or Steering Group) represents the technical leadership and management of the U.S. laboratories in LARP. The members are either involved in or very familiar with LARP activities. The Steering Group is consulted in the process of adding, dropping, or significantly modifying major LARP program components, or when policy issues arise. It is also consulted when names within the LARP organization chart boxes are changed, down to the level shown in Fig 1. The Steering Group usually meets twice per year, and the members often attend the LARP collaboration meetings that cycle among locations near BNL, Fermilab and LBNL.

*Current membership* (August, 2007):

Stephen Peggs (Chair), BNL, SMD, LARP Program Leader  
Giorgio Apollinari, Fermilab, Head of Technical Division  
Steve Gourlay, LBNL, AFRD, Leader of LARP Superconducting Magnet R&D  
Michael Harrison, BNL, Regional Director (Americas), ILC Global Design Effort  
Stephen D. Holmes, Fermilab, Associate Director for Accelerators  
James Kerby, Fermilab, Associate Head of Technical Division  
Tom Markiewicz, SLAC, Head of LHC Accelerator R&D Department  
Tor Raubenheimer, SLAC, Head of Accelerator R&D Division  
Peter Wanderer, BNL, Head of the Superconducting Magnet Division

## 2.6 U.S.-CERN Committee

The U.S.-CERN committee meets annually, towards the end of the fiscal year, in order to endorse current and planned LARP activities. The process of developing and evolving LARP planning involves many informal and formal contacts with CERN staff, including person-to-person meetings, phone, email, etc. Key in the process of developing mutually desirable and practical collaboration goals are the activities of the “LARP Liaison” at CERN, who works closely with the Program Leader. The annual meeting of U.S.-CERN Committee formalizes the consensus building, planning, and the activities that develop through the year. Most meetings are at CERN, at times with video conference attendance by some members.

*Current membership* (August, 2007):

Lyndon Evans (Co-chair), LHC Project Leader  
Stephen Peggs (Co-chair), BNL, SMD, LARP Program Leader  
Stephen D. Holmes, Fermilab, Associate Director for Accelerators  
Steven Kahn, SLAC, Director of the Particle and Particle Astrophysics Division  
James Kerby, Fermilab, Associate Head of Technical Division  
Philippe Lebrun, Accelerator Technology (AT) Division Leader  
Tom Markiewicz, SLAC, Head of LHC Accelerator R&D Department  
Steve Myers, CERN, Accelerators & Beams (AB) Division Leader  
Lucio Rossi, AT Division, Group Leader for Magnets and Superconductors  
Hermann Schmickler, AB Division, LARP Liaison & Controls Group Leader  
Jim Siegrist, LBNL, Associate Laboratory Director for General Sciences  
Peter Wanderer, BNL, Head of the Superconducting Magnet Division

## 2.7 LARP Advisory Committee

The LARP Advisory Committee (LARPAC) meets on an *ad hoc* basis, usually once per year. It is convened by the Program Leader in order to provide independent technical review of broad topics in the LARP program. The committee meets for two or three days, in order to hear presentations, develop a consensus, and to report its conclusions to the Program Leader. This internal LARP review mechanism complements the more formal program reviews called by the DOE Office of High Energy Physics, and the occasional internal laboratory reviews.

*Current membership* (January, 2006):

John Galayda (Chair), SLAC

Alex Chao, SLAC

Arnaud Devred, ITER

Joseph Minervini, MIT

Claus Rode, Jlab

Andrei Seryi, SLAC

Kai Wittenburg, DESY

Akira Yamamoto, KEK

## 2.8 Magnet Steering Committee

LARP activities are heavily matrixed, especially in Magnet R&D. Horizontal tasks involving multiple laboratories must be integrated into the vertical coordination of resources and infrastructure at each individual laboratory. The Magnet Steering Committee (MSC) provides a mechanism to manage and link the matrix for LARP Magnet activities. It meets several times a year, often through video conferencing, and includes email and telephone exchanges.

*Current membership* (August, 2007):

Peter Wanderer (Chair), BNL, LARP Magnet Systems Leader

Giorgio Ambrosio, Fermilab, TD, LARP L2 Coordinator

Shlomo Caspi, LBNL, AFRD

Paolo Ferracin, LBNL, AFRD

Arup Ghosh, BNL, SMD, LARP L2 Coordinator

Mike Lamm, Fermilab, Technical Division

Gianluca Sabbi, LBNL, AFRD, LARP L2 Coordinator

Sasha Zlobin, Fermilab, TD, LARP L2 Coordinator

## 2.9 Toohig Fellowship Committee

The Toohig Fellowship Committee advises the LARP Program Leader. It solicits, receives and evaluates fellowship applications, according to information and procedures described at the home page that it maintains:

<http://www.interactions.org/toohig>

There is one member on the committee from each of the 4 collaborating laboratories, one from CERN and one from the DOE. They serve overlapping three-year terms. Rotation on and off the committee occurs annually and is scheduled according to three groups, commencing in 2006 with group 1 (LBNL and SLAC), then 2 (DOE and FNAL) and finally 3 (BNL and CERN). Representatives from new institutions that join LARP will be assigned to one of these groups, according to the year of their entry. The chair serves a two-year term. In order to have two years available to serve, one of the three regions is naturally excluded as the home of the chair.

The committee works with the LARP Program Leader to nominate and approve new committee members and chairs. The Executive Committee endorses or rejects new chair nominations made to it by the Program Leader.

*Members serving until January 1 of [year]*

Angelika Drees (Chair), BNL [2009]

Roger Bailey, CERN [2009]

John Byrd, LBNL [2010]

Tom Ferbel, DOE [2008]  
Peter Limon, FNAL [2008]  
Uli Wienands, SLAC [2010]

## 2.10 Long Term Visitor Advisory Committee

The Long Term Visitor Advisory Committee (LTVAC) advises LARP management in the placement of scientists and engineers who will spend more than 3 months at CERN on Accelerator Systems business. It reports to the Accelerator Systems Division Leader, and through him or her to the LARP Program Leader. The Program Leader formally approves each LTV posting by sending a signed letter to the directorate of the proposed visitors home institution.

The LTVAC solicits, receives and evaluates LTV applications, according to information and procedures described at the home page that it maintains at <http://uslarp.org/LTV>. The committee provides a mechanism to ensure that LARP visitors from U.S. institutions are fully integrated into activities at CERN, and to ensure that the best qualified candidates, according to many criteria, are selected for these tasks. In order to do this, consistent with the LARP mission and with LHC needs, the LTVAC:

- assembles candidate applications, in an impartial and continuous process that covers all LARP institutions and all Accelerator Systems topics
- updates confidential data tables describing candidates and their potential involvement in LARP tasks at CERN, with full revisions established at least twice per year. New revisions are made available for review and endorsement during each collaboration meeting.
- ranks a prioritized list of proposed new Long Term Visitors, at least once per year

There is at least one member on the committee from each of the 4 collaborating laboratories and CERN, including the Accelerator Systems Level 2 head of Commissioning, ex-officio. The term of the committee members is not fixed except for the chair, who serves a two year term. The committee works with the Accelerator Systems Division Leader and the LARP Program Leader to nominate and approve new committee members and chairs. The Executive Committee endorses or rejects new chair nominations made to it by the Program Leader.

The institutions participating in LARP have agreed to the following common guidelines for support of LTVs:

1. For junior staff, LARP supports salary, travel and living expenses.
2. For senior staff, LARP supports travel but the home laboratory supports salary, subject to mutual interest and to case-by-case agreement by the home laboratory. Living expenses are shared by the home laboratory and by CERN, subject to mutual agreement.

*Current membership* (September, 2007):

Mike Syphers (Acting chair), FNAL  
Mick Draper, CERN  
Wolfram Fischer, BNL  
Tom Markiewicz, SLAC  
Alex Ratti, LBNL

## 2.11 Environment, Safety and Health

LARP is committed to working within an ES&H program that meshes with the policies of the CERN Safety Commission. The U.S. LARP Program Leader has overall responsibility for ensuring that all members of LARP work together with the Group Leader in Matters of Safety (GLIMOS) to satisfy all LARP-specified safety regulations, and that all institutional ES&H requirements are fully met for work performed. In April 2007 LARP adopted a notification procedure for any accident determined serious by the LARP management, whereby the members of the

LARP Laboratory Oversight Group will be kept informed about details of such an incident and any follow-up. The LARP Program Leader will also inform the Director and/or the Head of ES&H at the host lab, FNAL, as well as LHC Program Manager and Deputy in the DOE and NSF. The LARP Program Leader can then follow-up any issues raised by any incident.

## 3 INTERNAL MANAGEMENT

The LARP collaboration is dispersed geographically, but relies on the resources and infrastructure of individual laboratories. Internal management of LARP rests largely on modern communication technologies, using the web, email, phone, and video conferencing tools. It is possible that the advent of commodity video conferencing tools will revolutionize the way that “collaboratories” such as LARP work, enabling remote operations, diagnostics, and maintenance. Even so, it is likely that in the long run LARP management and operation will continue to demand much travel – domestic and foreign, both programmatic and task oriented.

### 3.1 Work Breakdown Structure

The LARP budget and other functions are organized around lines of deliverables, or tasks, at Level 4 of the Work Breakdown Structure (WBS). Each task has a “Task Leader” – a person at one laboratory who takes intellectual and technical responsibility for the work performed at multiple laboratories. Closely related tasks are grouped together at Level 3 in the WBS, and they are managed by “L2 Coordinators” at Level 2. The LARP organization chart in Fig. 1 shows another view of how the Level 2 activities and the L2 Coordinators in the lower boxes fit into the Level 1 major program divisions of Accelerator Systems and Magnet R&D. (The third Level 1 activity, Program Management, is not shown in the organization chart.)

Changes in the names of Task Leaders need approval from the appropriate Division Leader and the Program Leader. Changes in L2 Coordinator and Division Leader (Level 1) also require approval of the Executive Committee. Changes above Level 2 require concurrence of the Joint Oversight Group and approval from the U.S. LHC Program Office.

### 3.2 Tasks Sheets and Milestones

All four LARP institutions participate in multiple tasks. In most cases, a particular task involves two or three laboratories, although some tasks are focused in a single laboratory. Outside LARP, there are many examples of “bilateral” tasks that are performed between CERN and a single U.S. laboratory or university. The list of LARP tasks is not fixed – tasks have life spans from about 6 months to indefinite periods. This is consistent with the nature of LARP as a research program rather than as a project with hard deliverables. Task goals, budgets, schedules, and milestones (typically for the next three years) are described in “task sheets” that are posted publicly, and which are revised annually.

Task sheets are written and maintained by the Task Leaders. Effective task management requires the Task Leaders to maintain good communication between the labs, to develop consensus agreement on task goals and their implementation, and to monitor technical and financial progress at each of the labs, despite the lack of full financial control of the tasks, but only signature authority over budget codes at their own laboratories. Approval of the content and evolution of each task sheet, and supervision of the progress of each task, is the purview of the appropriate L2 Coordinator, the Division Leader (Accelerator Systems or Magnet R&D) and ultimately of the Program Leader.

Milestones included in task sheets are used as an aid in predicting and tracking the progress of each task. Because LARP is a research program and not a construction project, milestones should in general not be interpreted as hard deadlines for the production of hard deliverables. Nevertheless, specific expected deliverables must come in on time and within budget. Coordinated lists of division milestones are maintained by the Division Leaders, modified at least annually, and posted publicly.

### 3.3 New Task Proposals

LARP maintains an “open door” policy for new tasks. A successful task-sheet proposal should indicate the extent to which R&D activity falls within the goals of LARP, how it can be accommodated within the LARP budget and into the LARP schedule. Consideration is given to the alternative possibility of supporting a task as a bi-lateral activity outside LARP. Sometimes, minor new tasks evolve naturally from previous tasks, and do not require discussion by the collaboration at large, but simply approval by the Division Leader and the Program Leader. Discussion is required at a collaboration meeting when a proposed task represents new scope for the LARP program. Major new tasks enter the LARP program most naturally at the beginning of a fiscal year, after approval through a Change Control Procedure.

### 3.4 Change Control Procedure

The LARP Change Control Procedure (CCP) is a function assigned to the Executive Committee, which meets at least once per year to approve any proposed modifications to LARP scope (list of tasks), or significant modifications proposed to the schedule or level of funding of those tasks. Schedule and funding modifications are defined significant when they involve 6 months or \$100k levels, respectively. The Program Leader presents any proposed change after consultation with the Division Leaders and other appropriate members of LARP technical management. Executive Committee meetings to act on CCPs are called each fiscal year before a final budget request is made. Meetings can also be called on an *ad hoc* basis.

### 3.5 Collaboration Meetings and Reviews

Collaboration meetings are held at least once per year for two or more days, on a schedule that is phase locked to the fiscal year, and hosted in rotation by BNL, Fermilab, and LBNL. These meetings, the largest held by LARP, provide an opportunity to look at all technical aspects of the LARP program, with all presentations made available on the web. A variety of satellite meetings take place just before and after collaboration meetings, taking advantage of the large number of gathered collaborators. Although these meetings are also a natural time to discuss LARP financial issues and planning, this is not a primary goal, since open discussion of LARP finances is appropriate only to a certain degree.

LARP activities are subject to review by the DOE, by the LARP Advisory Committee, by internal laboratory review committees, by the LARP Advisory Committee, and by LARP internal committees. The technical and planning perspectives of CERN are actively sought in all cases.

### 3.6 Budgets

The budget is ultimately the responsibility of the Program Leader, notwithstanding the high-level approval that is sought annually through the Change Control Process. Tuning of budget allocations during the operating fiscal year and planning for future years is done in consultation with the program Division Leaders and the L2 Coordinators who are, in turn, in communication with the Task Leaders. The Program Leader distributes approximately 70% of the total LARP allocation to the four laboratories at the beginning of each fiscal year. The remaining 30% is disbursed early in the third quarter of the fiscal year, with a distribution that is contingent on the way the needs of the program evolve. This provides a flexible response in tuning the budget to support the tasks with greatest needs and highest priorities, according to the best judgment of the Program Leader.

### 3.7 Letters of Agreement and Endorsement

Letters of Agreement are written once per fiscal year between LARP and each of the collaborating U.S. institutions. These letters are non-binding MoU-style agreements that outline the roles and responsibilities of each laboratory within the evolving level of LARP funding. They are signed by the Program Leader and by one or more senior representatives from each laboratory.

A Letter of Endorsement is written and signed once per year by the chair of the CERN-U.S. committee. This letter signifies approval by CERN of the LARP plans for the following year, within the context of the long-term goals of LARP, including involvement in upgrades of LHC Interaction Regions.

### 3.8 Engineering Design Documentation

The CERN Engineering Design Management System (EDMS) is used when a level of definition and agreement is needed with CERN beyond that afforded through the annual Letters of Agreement and Endorsement. This would be the case for all hard physical deliverables, such as instrumentation for beam diagnostics. The EDMS allows precise delineations of responsibility between CERN and LARP, as well as the documentation of technical specifications and operational modalities.

### 3.9 Quarterly and Semi-annual Reports

Quarterly financial reports are distributed within the collaboration to the L2 Coordinators and Task Leaders. Each monthly report includes a lab-by-lab and task-by-task breakdown of budget allocations, amounts spent so far, and remaining funds. Reports are assembled by the Program Leader from information provided by financial staff at each of the four labs.

Semi-Annual financial reports are based on the same spreadsheet reporting format as the monthly reports, but with narrative added by the L2 Coordinators, Accelerator Systems and Magnet R&D Division Leaders, and the Program Leader. After assembly and editing by the Division Leaders, and then by the Program Leader, they are distributed to L2 Coordinators, Task Leaders, the Office of the U.S. LHC Research Program, and to the LARP Executive Committee. They are also available at the LARP home page [1]. The structure of the document follows the WBS, with a narrative discussion of the progress towards program goals, status and issues within tasks, and an executive summary.

## References

- [1] LARP home page, <http://www.rhichome.bnl.gov/LARP> or <http://www-td.fnal.gov/LHC/USLARP.html>
- [2] *The U.S. LHC Accelerator Research Program: A Proposal* unpublished, May 2003
- [3] *LHC Luminosity and Energy Upgrade: A Feasibility Study*, O. Brning et al., LHC Project Report 626, December 2002.
- [4] *Physics Potential and Experimental Challenges of the LHC Luminosity Program*, F. Gianotti, M. Mangano, T.S. Virdee et al, CERN-TH/2002-078, April 1, 2002.
- [5] *High-Energy Physics Facilities of the DOE Office of Science Twenty-Year Road Map*, HEPAP report to the Director of the Office of Science, 17 March 2003.