Request for Comment: White Paper on the Comprehensive Project Design Guidance (CDPG) for the International Linear Collier

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Preamble

In the early 2000's several study reports were issued by Asian, European and American regional bodies, representing the relevant high-energy physics communities, on the need for a Linear Collider (LC) and its possible organizational structure. Concurrently with these regional reports, the Consultative Group on High- Energy Physics of OECD, also issued a report which was formulated through consultation by representatives from both the research and administrative communities from the world.

All these reports agreed that a high-energy electron-positron LC is a next major facility on the roadmap of the world high-energy physics, and this project would require a hitherto unknown scale of global collaboration which calls for special attentions by the research, administrative and political sectors in the world. Together, these reports laid the foundations for a world organization for the design development stage of an LC, leading to establishment of the Global Design Effort (GDE) for the International Linear Collider (ILC).

These regional and international reports systematically identified most of the organizational, legal, budgetary and political issues associated with construction and management of an LC project. Many of the issues pointed out there still represent valid questions to resolve as of now.

However, what is somewhat missing in our community, are the shared consensus on the solution model (or models) to address these issues during the project construction and management, and an evolutionary path in which such an organization is ultimately put in place. In the technical front, the GDE is presently engaged in producing a Technical Design (TDR) of the ILC Project before the end of 2012, and in synchronization, the detector concept groups are preparing the Detailed Baseline Documents (DBDs) under the leadership of the Research Director. The TDR and the DBDs, when completed, will be presented to the communities and interested government agencies. Therefore, it seems adequate for us also to draft the Organizational or Governance Design for the ILC Project in a similar timescale.

The purpose of drafting the Comprehensive Project Design Guidance (CPDG) is to prepare our prospects, preference and understanding on the guiding principles for the project design and project execution for the ILC, and to synthesize them into a coherent single document (CPDG Document).The intended audience of the CPDG Document include the following: the members of the world HEP research communities; the members of neighboring research communities at large; the relevant parties in the political, bureaucratic and industrial sectors of interested nations and regions; the relevant international organization.

The participants for the preparatory effort on the CPDG are expected to be an internationally consolidated research community on HEP in the world, under coordination and direction by the ICFA and its subpanel ILCSC. To facilitate our discussion on these issues of the ILC, the subgroup within ICFA conduced a pilot study to examine how to structure the issues to address and to create a mapping as to which parties within the relevant communities could most adequately examine each of such issues. The eventual goal of this pilot study is to lay down the work plan for arriving at a Comprehensive Project Design Guidance – CDPG, through discussion and consultation among the members of the HEP research communities in the world. The plan of work, as suggested by this pilot study is summarized in Appendix A.

It should be understood and emphasized that we, the members of the world research community on HEP, cannot fully substitute the legitimate bodies for managing the inter-governmental issues from the administrative or political perspectives. The issues to be managed by these experts must be left for them. Therefore, the CPDG will focus on making statements from the standpoint of the primary executioner of the research, on presenting our desire from the scientific and technical viewpoint, wherever applicable, and on informing all the relevant members in our societies of the outcome of our study.

Fully systematic surveys of the CDPG issues, as enumerated in Appendix A, are yet to begin. However, preliminary thoughts have been given on some aspects of the CPDG, such as our Philosophical Principles, the Top-level Management and the Site Selection Process. The purpose of this Request for Comments (RFC) is to present the preliminary results of these studies, together with an outline the missing contents to fill in for the CPDG, and to invite inputs from the members of relevant international research communities, so that the CPDG effort becomes a shared activity with a clear goal among the relevant members of the world HEP community. We aim at producing an interim report of CPDG Document in 2010, with a fuller version by the end of 2012. The CPDG, as found appropriate, may grow into a working reference to guide the project during the subsequent period.

0. CPDG Principles (IL0)

The ultimate goal of the CPDG Document is :

1. To lay down a set of guiding principles,
2. With proposals for specific solution models and timeline scenarios,
3. For the world HEP community,
4. So as to construct the International Linear Collider,
5. Which is built on schedule,
6. Within budget,
7. With the intended performance,
8. To deliver the desired research opportunities,
9. For all the interested and competent scientists in the world, in a fair and equitable fashion.

With this ultimate goal in mind, we summarize here the critical features that we believe the CPDG Document should foster. While most of them belong fundamentally to the well-known commonsense within the world HEP community, the list here should provide us with useful “calibration points” to assess the adequacy of each of the specific solution models for us to develop for the CPDG.

A. Openness to the world:

The high energy physics has been keeping an international nature from its birth. This is connected with its mission to clarify the most fundamental laws of Nature and the universe, where the discoveries and the results should naturally be deemed as the common assets of every human being.

Our basic principle is that high energy physics should be pursued independently of any political, national, ethnic, or other constraints. The opportunity for research has been, and must be, equally open to all scientists in this field, as formulated in the ICFA guidelines, whether such scientists are from nations on the frontier of high energy physics research or not. We should consider that the ILC project is a novel and unique opportunity for us to realize internationalization and cooperation in our field on a global scale, with numerous positive implications on the science, technology and education in the world. This is perhaps one of the most important aspects, as seen by the general populace, that the LC project can contribute to the world.

B. Solid legal base

Several different organizational models are conceivable for managing the construction, commissioning and operation of the ILC. Irrespective of the specific details of such models, a clear legal status needs to be defined for an organization to manage the ILC project execution. The adequacy of the organization and its management need to be assessed from the standpoint of how its legal structure is expected to effectively fulfill the following points:

As a scientific project, any nations / regions with intentions to make tangible contributions may join. Large amount of contributions from a multiple number of participating parties are shared. Solid accountability is ensured in both the scientific / technical and budget / financial aspects.

C. Long-term stability and short-term agility

The organization has to implement a mechanism that allows its long-range stability, in terms of maintaining the productivity and the continuity of the project, as well as short-term agility to cope with short-term "glitches" in the project execution in both the technical and financial contexts.

ILC project will go through a multiple number of evolutionary steps toward construction and operation (see above). An early stage of ILC organization cannot be completely static, in particular, because the participating countries / regions may or may not be able to go through the required approval process in complete synchronization. ILC project, including construction, will have a life-span of ~ 20 years or longer. Successful project execution needs predictable budget prospects with a good stability. ILC project may encounter technical of financial issues which require us to take rapid countermeasures within a short time scale, such as few months or less. Some elements within the ILC organization have to be assigned a certain degree of authority and autonomy and access to its reserved budget to take required actions in a timely fashion .

D. Evolutionary steps to follow, when the ILC lab is being approved and formed.

Although the organization for construction, commissioning and operation of the ILC has to strive to establish a long-term stability of its operation, it is also expected that this organizational structure may not be put in place in "a single shot" from the beginning. The project approval at the national and international levels, signing on the agreement, site-selection and launch of component manufacturing may have to evolve in parallel efforts. Therefore, a proposal for the ultimate form of the ILC organization must be made together with an evaluation of how such an organization is to be formed in an evolving fashion, in particular, with the following points in mind:

Design, R&D, costing and technical validation studies of ILC are currently on-going. Manufacturing studies and site-specific construction studies are expected to follow and to intensify. Processes of site selection, budget approvals and assignment of work sharing then will have to take place, before ground-breaking and formal construction starts. Then come the system commissioning, operation and possible upgrades. The ILC organization and its oversight bodies (or, at least, part of their DNAs) should observe them all.

E. Intellectual properties

The Article 8 in the "MoU for the Establishment of a Technical Design Phase of the Global Design Effort Concerning the International Linear Collider"[1] gives the established agreement on the intellectual properties issues for the current stage of GDE.

An analysis and proposal is called for as to how these present principles may continue to stay valid for construction and operation phases of the ILC, or if they need revisions, how they need to be revised and why.

F. Health of participating and other HEP institutes.

A collaboration for a major project must maintain and foster the scientific culture of all participating institutions, and maintain the visibility and vitality of each of the partners. The ILC project should be executed in this same spirit and be managed in a manner which allows the participating parties to accumulate certain technical competence, knowledge base and a positive economic impact, as a return to the society at large.

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[1] http://www.fnal.gov/directorate/icfa/ILC_GDE_MOU_June2008.pdf

Physics experiments at any major HEP accelerators are currently managed in accordance with "ICFA Guidelines for the Interregional Utilization of Major Regional Experimental Facilities for the particle Physics Research": http://www.fnal.gov/directorate/icfa/icfa_guidelines.html .

The ICFA Guidelines have been serving quite successfully for execution of international research programs at large accelerator facilities. However, some aspects of the ILC is most likely to go outside the scope of the existing guideline, since major portions of construction and operation budgets may have to be internationally shared, rather than regionally or nationally.

From the perspective above, the present ICFA Guideline might need to be annotated by adding a few statements on "Global" projects, in which major parts of construction and operation budgets are shared. This issue requires a careful analysis. An attempt should be made to clarify the separation, connection and co-existence between the ILC-like- and non-ILC-like- (consequently, more traditional) international projects.

The subjects as outlined above need to be analyzed in a time line. It is particularly important when the evolutionary nature of the ongoing R&D and the steps to follow when an laboratory organization for the ILC is formed in parallel and serial fashion in both the national and international context. Figure 0-1 shows a birds-eye view of a possible timeline toward realization of the ILC.

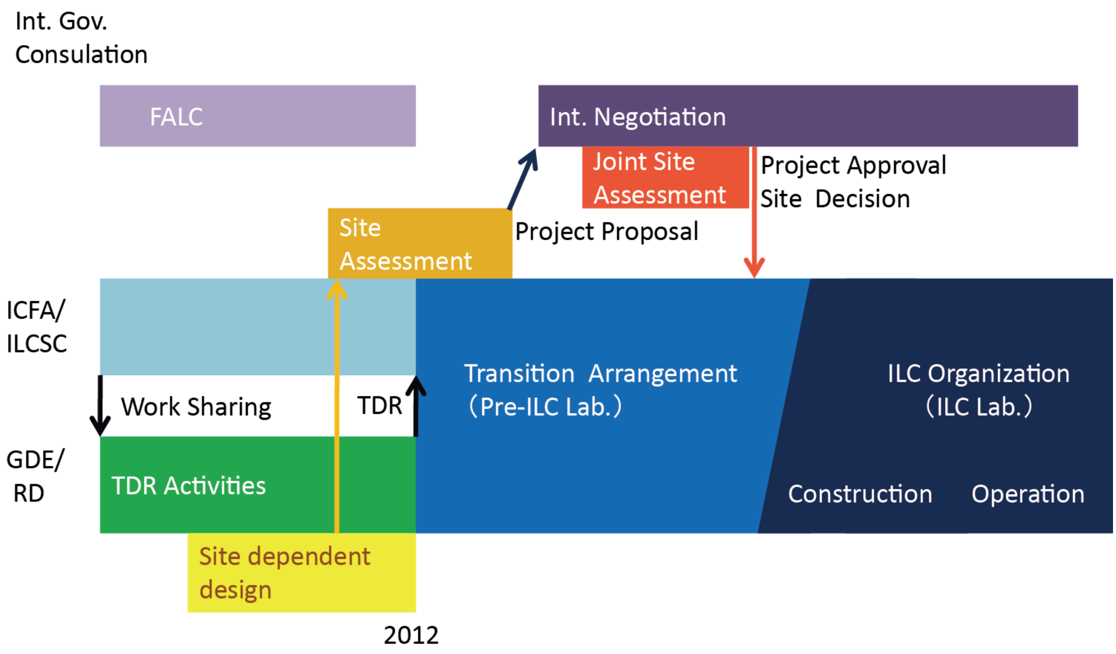

Figure 0-1: A possible timeline toward realization of ILC.

One of the important consideration to take note of is the separation of technical / scientific and political aspects – Without doubt, the final negotiations and decisions concerning the legal agreements, budget sharing and site selection for the ILC will have to be made by suitable, relevant government agencies of the interested nations / regions. On the other hand, the technical contexts and resultant boundary conditions or specifications for the project (such as the base performance parameters or the technical specifications for possible sites) should be dictated by the scientific merits, and this aspect must be protected from arbitrary political compromises.

Therefore, we propose that we make systematic efforts to identify "where the scientists end, and where the government officers and statesmen begin" or vice versa, and develop our analysis accordingly. A notable example is the issue of site selection. Here, we propose that the members of the academic sector play leadership roles in defining the specifications while the members of the bureaucratic and political sectors make the best executive judgment among the candidate sites which are known to satisfy the pre-established technical specifications.

1. Top-Level Management (IL-1, GD-0)

1.1 Assessment of possible model examples

1.1.1 Institutional Models from the Legal and Procurement Standpoints

A survey was made on existing organizational models in high-energy physics and related field of science where significantly large international collaborations were actually managed: CERN, ITER, ISS and XFEL. Through some iterations, a number of “points of comparison” were extracted and accordingly, a comparison table was created to summarize their features, benefits and issues (Appendix B). This section presents a condensed summary of the analysis on the basis of this exercise. In this analysis, two “coordinates of variables” as shown in Figure 1-1 were considered:

- One, with regards to the “legal basis of the organization”, and
- Another, with regards to the “style of procurement of the resources during construction, and during operation”.

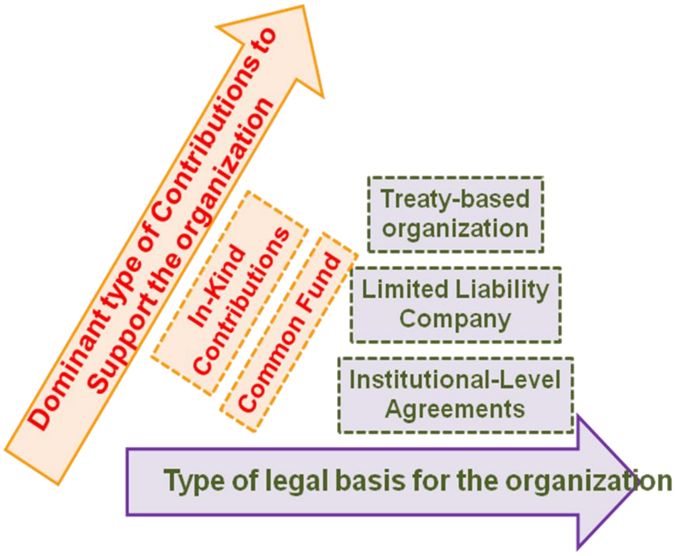

Figure 1-1: Two “coordinates” which characterize the nature of each of the existing or perceived organizational models in high-energy physics and related field of science where significantly large are managed.

For each of these two “coordinates”, the following representative cases are conceivable:

A. Legal basis of the organization

- Treaty-based organization
  - Members: Signatory nations of the treaty
  - Benefits: Stability of the budget when it is shared by a large number of members, legal privileges on the basis of international legal foundation
  - Issues: International negotiation and ratification processes which are feared to take a long time.

- Limited-liability company
  - Members: Co-investors

- Benefits: Relatively rapid formation process
- Issues: Fact that it is subject to domestic laws of the host nation. Stability of the budget when it is shared by a smaller number of members or when it is dominated by the host.

• Institution-level Agreements
  - Members: Signatory institutes of the Agreements.
  - Merits: rather rapid formation process.
  - Issues: Some steps may have to be taken for reinforcement of commitment by the member institutions, since, otherwise, the legal foundation might not be firm enough to ensure stable, continuous contributions by the members.

B. Procurement of Resources

• In-kind contributions
  - Benefits: "Juste retour" -- Contributions by each nation / region are likely to foster the growth of domestic industrial capabilities and activities. Likewise, emerging nations could utilize their contributions to grow their own domestic technical capabilities, in particular, if technology transfers from nations with more advanced capabilities take place. Work-load on the on-site staff and the host could be reduced.

  - Issues: Additional effort is needed to ensure the consistency of the component designs and manufacturing processes. This procurement style, if it becomes dominant, may not result in the most cost-effective, time-efficient construction scenario in some cases. Countermeasures need to be prepared for potential cost increases and prolonged procurement processes or the delays.

• Common-fund
  - Benefits: Optimization and consistency of the component design is more enforceable. Risk mitigation, cost reduction, countermeasures against procurement delays are deemed more manageable, because of the centralized procurement practice.
  - Issues: Specials measures may have to be introduced to facilitate "juste retour". Work-load on the on-site staff and the host could be increased.

The organization for the ILC management for construction and operation may take a combination of in-kind contributions and procurement with the common-fund. In this case, depending on the relative weight of these procurement methods, which in fact can change as function of time, the organization should assume varying degrees of benefits and issues, and will have to act accordingly.

Responsibilities of the central team on site and the support staff there may include the following:

During construction: Finalization of the system design and component designs; management and execution of the construction schedule (inspection and acceptance test of components procured with common fund, QC, crisis management); administrative tasks (contract, accounting, personnel, safety, maintenance, etc).

During operation: Management of operation schedule; management of operation and tuning; planning, coordination and execution of maintenance and upgrade; administrative tasks (contract, accounting, personnel, user services, safety, etc).

Responsibilities of the member laboratories stationed *on site of the ILC* may include:

> During construction: On-site management of their own in-kind contributions (inspection and acceptance of contributed components); assistance and support for the central team members; participation in the central team as seconded personnel; management of the local account from the home laboratory at the ILC site.
>
> During operation: maintenance of the contributed components; assistance and support for the central team members in operation and maintenance; participation in the central team as seconded personnel in operation and maintenance; management of the local account from the home laboratory at the ILC site.

The scheme of the responsibility sharing given above is for an illustration purpose. The specifics will have to be examined individually. For instance, a number of component assemblies at the ILC, in fact, may consist of subassemblies from a multiple number of institutions, which may be procured as mixtures of in-kind contributions or with the common fund.

It is noted that the composition of the on-site personnel of the central team (i.e. how many there will be, from each of the collaborating institutions / nations) will have to be determined in accordance with *both* the technical demand and the fractional contributions made by each of the collaborating institutions or the nations. There may be cases, however, that the technical demand has to take precedence over the latter.

1.1.2 Representative Models for the ILC

As for the legal models listed in Section 1.1.1, a likely solution is for ILC to adopt one of them as *the choice*, rather than taking a mixture.

As for the procurement style, both the in-kind contributions and the common fund are likely to prevail in some fashion, independent of which legal model to adopt. Hence, the question is how the two procurement styles might dominate or co-exist throughout the project lifecycle.

Therefore, we have picked up the following four as the typical "samples" for further considerations:

Model 1: Treaty-based + mostly common-funded : CERN-like model
Model 2: Limited-liability company + mixture of common-fund and in-kind contributions: XFEL-like model
Model 3: Treaty-based + mostly in-kind contributions: ITER-like model
Model 4: Lab-Agreement-based + mostly in-kind contributions: Multi-national Lab model

This RFC focuses on Model 3 and Model 4 for reasons of time constraints in preparing this document, and for reasons of their nature of decentralization and partnership which are considered valuable attributes for conducting the ILC project. While not completely excluded from future analysis efforts, Model 1 is considered to take a longer time for realization, because of the negotiation and ratification process of the treaty. On the other hand, it may be possible to transform a Model 2, 3 or 4 organization into a Model 1 organization at some point in the future when the participating nations find it appropriate to do so.

Likewise, further discussion on Model 2 deferred. Model 2 is subject to potential issues stemming from its dual management structure which involves the limited-liability company and its stake-holders.

1.1.3 Model 3 : "ITER"-like Model

This is a case whose legal basis is treaty-based and whose resources are supported mostly by in-kind contributions. An excerpt follows from a detailed discussion which is presented in a document titled, "Governance of the International Collider":

a. Legal Status

The organization to construct and operate the ILC is set up as an international treaty organization similar to ITER, taking advantage of zero VAT rating and similar privileges.

b. Management Structure

As the ultimate governance body for the ILC organization a strong Council is created. Delegates in the Council should be of sufficient standing so as to make decisions in a timely fashion. The ILC organization has a Director General (DG) and a Directorate. The latter is proposed for Council ratification by the DG. The DG has significant delegated authority from the Council, allowing him or her to act decisively without continual need to refer back to Council.

c. Representation and voting structure in governing body

Each member state[2] sends 2 official delegates and a maximum of 2 advisors to the council. One of the two delegates is a particle physicist. An option is provided, every few years, for holding Ministerial Council Meetings, in which delegates are the relevant government minister.

Council make decisions on questions by simple majority for issues not of a financial nature. Financial questions are decided by a qualified majority voting, whose weights are adjusted in accordance with financial contributions plus a majority of individual member states.

d. Duration of ILC Agreement

The ILC agreement is fixed term – for instance, a construction period of ~9 years plus 20 years of operation. This agreement, however, is extendable by agreement of Council in periods of 5 years. After the agreement comes into force, withdrawal would not be allowed in the first 10 years. When the first 10 years is passed, withdrawal is possible with the mandatory grace period of 1 full year.

e. Attribution of in-kind contributions, value engineering, etc.

The ILC construction project is based on a Work Breakdown Structure (WBS) system. In-kind contributions will be likely to form the majority of contributions to the project's infrastructure. An agreed register of WBS items should be set up and a committee constituted to consider bids for WBS items from member states. Value engineering should be used in defining the "value" of each WBS item. There should be an adequate Common Fund (of at least 20%) in order to give management enough flexibility. There should be no strict "juste retour".

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[2] The definition of a "member state" should be as flexible as possible and include groupings of nations represented by a coordinating body, for example, CERN and JINR

f. Contingency

If and when needed, the Council should have the authority to call on a central contingency budget with a maximum of 10% of the total project cost and to allocate it as appropriate. Increases in costs to produce a WBS item smaller than 25% or some other agreed ceiling in cash should be borne by the country with responsibility for that item; they are recommended to have appropriate internal contingency. It is important to avoid double counting between the central contingency and a country's internal contingency in arriving at the overall project costing. If costs for a WBS item increase beyond the agreed ceiling, the case could be referred to and considered by a standing Board and either referred back to the submitting country or referred to Council for release of central contingency, as appropriate.

Exhaustion of the central contingency should lead to appropriate descoping of the project to be decided by management with Council's agreement.

g. Running costs & decommissioning

Running costs should be evaluated at the time of setting up the organization and a suitable algorithm agreed to. A commonly chosen algorithm is that running costs should be distributed roughly proportional to capital contributions.

Decommissioning should be the responsibility of the state that provided that WBS item; the Host State should have residual responsibility.

h. Comments on Model 3

i. Evolutionary Scenario for Model 3

1.1.4 Model 4 : Multinational Laboratory Model

The governance for the global projects should be established on the balanced partnership between the project management, which is located at a central host institute, and the participating institutes, which are distributed across the world. Each of the HEP-labs in the world, which wishes to participate in the project (a Multinational-Lab), sets up its branch within that Multinational-Lab as shown in Figure 1-2. These participating HEP-labs are called member-labs. The formation of this Multinational-Lab may be realized as a relatively smooth expansion of the present management bodies for the R&D and Design effort for ILC, namely, the GDE and the RD.

a. Legal Status

The Multinational Lab for ILC is formed on an existing legal basis of an existing host laboratory which signs on Agreements (or MoUs) with member-labs. These Agreements may be endorsed via inter-government-level agreements among the nations to which the host and member-laboratories belong.

b. Management Structure

The council of this Multinational-Lab comprises the representatives from the member-lab branches. We note here that the academic members (scientists) are to take the responsibility on the operation of Multinational-Lab.

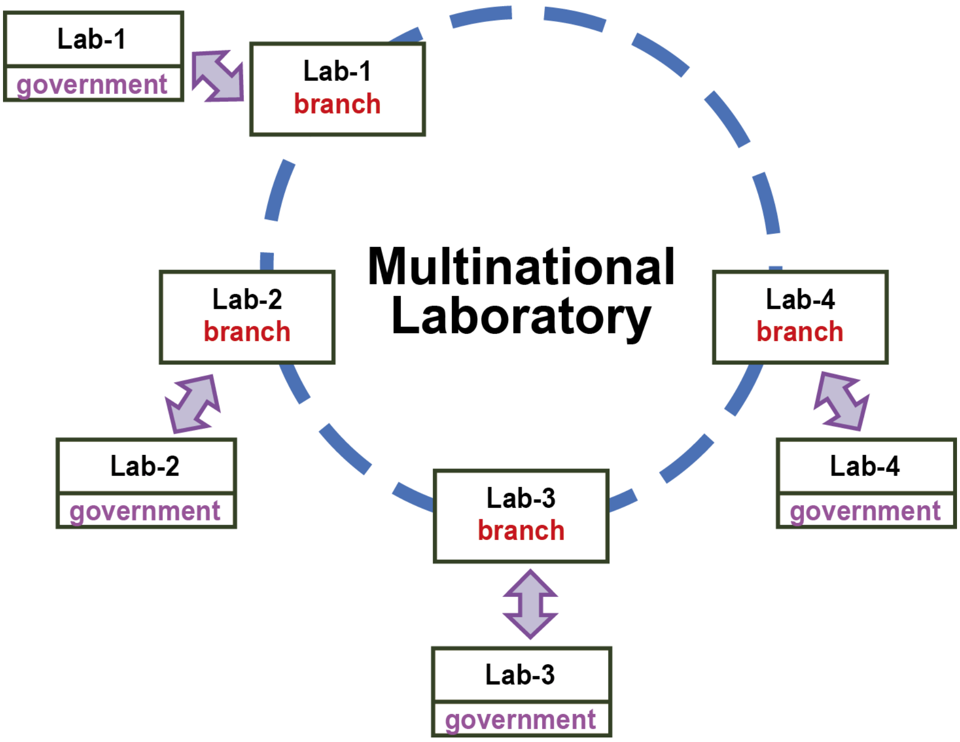

Figure 1-2: A conceptual supporting model of a multinational-laboratory.

c. Representation and voting structure in governing body

In order to assure that experimental physicists across the world gain access to the projects, various kinds of participating form should be arranged with being: like a member, an associate-member, an observer, a non- member and so on.

Financial matters will be determined via voting with certain weights in accordance with the relative amount of contributions. Scientific matters will be determined via technical / scientific discussion by members on an equal footing.

The organizational chart and the reporting scheme, as shown in Figure 1-3, would be much similar to those of CERN.

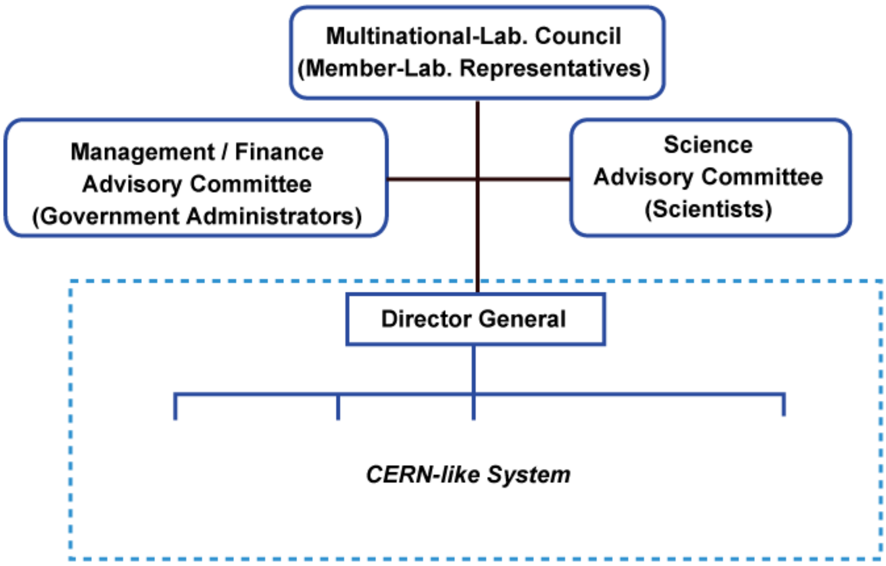

Figure 1-3: Possible organization chart and reporting scheme for the Model 4 organization.

d. Duration of ILC Agreement

Duration of the agreement, provisions for extension of the agreement, provisions for withdrawal, penalties, etc need to be worked out.

e. Attribution of in-kind contributions, value engineering, etc.

Procurement of materials and equipment is done mostly through in-kind contributions. Formulas must be developed for cross-evaluating the values of different types of in-kind contributions.

According to the agreement on the governance policy, the member-labs contribute in sharing the human resources (scientists, engineers, technical staff and administrative staff), and the financial resources (common fund with a certain overhead and in-kind contributions). Composition and amount of these contributions of human and financial resources would depend on the project stage in progress (construction, commissioning and operation) as well as on the type of member-labs (hosting or else).

Many of the on-site personnel is mobilized mostly as seconded personnel from member-labs. The member-labs have to work out the adequate working conditions (salary, insurance, pension and retirement plans, etc) for the employees who work at their branches in suitable accordance with their own regulations and the international standard. However, some of the one-site personnel may have to be hired on-site, too.

f. Contingencies

Each of the member-labs is responsible for contingency issues associated with the assigned in-kind contributions. A certain amount of common-fund is deemed necessary, however, for crisis management. Crisis situations in a bigger scale will be managed by contributions by other member-labs or re-scoping of the project / operation via discussion and approval by the Council.

g. Running costs & decommissioning

A framework of new governance which makes it affordable and acceptable for us to realistically share not only the construction costs but also the running/operation costs among the participating laboratories or countries.

h. Comments on Model 4

Even while major portions of material procurement may be done through in-kind contributions, and while major portions of on-site personnel may be provided by member-labs, the need would not disappear for the central team with their support staff to manage the system integration and operation. When this team is to be formed as a mixed team of seconded personnel from the member labs, the following two potential issues will have to be addressed:

- Dual management structure.
- "Maroon" problem.

Dual management structure refers to the fact that members of the central team becomes under two command chains, one from the central team itself and the other from the member-lab to which he or she belong. This may be addressed by hiring the core members of the central team with the common fund so as to strengthen their independence from the member-labs. This could serve as a sufficient solution if the project remains attractive and the members share a strong sense of common mission. In this case, the so-called "Maroon problem", alienation of the seconded personnel from the member-lab where he or she come from, is unlikely to become an issue. The member-lab's providing the personnel as seconded personnel, if managed adequately, should contribute to secure the mobility of the experts between the branches at the ILC site and the member-labs.

i. Evolutionary Scenario for Model 4

A possible evolutionary path toward establishment of the ILC organization with Model 4 may be depicted by Figure 1-4.

Figure 1-4: A possible evolutionary path toward establishment of the ILC organization with Model 4.

Completion of the TDR and DBD in 2013 marks conclusion of the present mandate for the GDE and the RD. At that point, the GDE and RD are dissolved and a new multi-national laboratory is founded so as to coordinate the remaining technical and engineering effort in both the accelerator and physics / detector areas. We called it the "pre-ILC lab". The pre-ILC lab is the precursor body for the ILC organization to be eventually established.

Some notable features of the pre-ILC lab and the issues to note are as follows -

- The organization of the pre-ILC and its counseling bodies have to be brought one step forward from those during TDP. The participating laboratories, upon agreement, have to commit their resources and efforts in a manner more specific from those during TDP, with a very explicit goal of bringing the ILC into reality. For this purpose, the present ILCSC is re-formulated as the Council for the pre-ILC. Likewise, the management structure within the pre-ILC explicitly consists of the representatives from the participating laboratories.

- One of the main missions of the pre-ILC lab in the technical front, is to build and demonstrate operation of a realistic prototype linac system which represents *a very-close-to-real-life partial model of the ILC main linac*. Since this effort constitutes the most critical element among numerous technical topics for the ILC, the headquarters office of the pre-ILC lab is placed at the site who hosts this prototype linac system.

- The pre-ILC lab also coordinates the efforts on other remaining technical and engineering efforts as left by the GDE and RD. These efforts may be pursued in a distributed fashion, similar to the Technical Design Phase.

- The pre-ILC lab continues its operation on the basis of pre-construction budget, i.e. without the guarantee of proceeding with actual project construction. The latter can be obtained only after formal project approval is granted by relevant government bodies. Therefore, in the social and political front, the most significant mission of the pre-ILC lab is to facilitate the effort by numerous scientific bodies and their representatives toward the negotiation process with the government agencies in various combinations.

- The pre-ILC lab plays the role of "the originator" of the required technical information, including: scientific merits of the project, technical feasibility and health of the project, reliable cost estimate, proof of existence of the sufficient expert population in the academic and industrial sectors for successful project execution. The pre-ILC lab has to produce these technical data, which are continually suitably updated, and assist members of the participating laboratories in creating materials required for their interactions with government agencies and media.

- The main mission of the pre-ILC lab in the engineering front, while pursuing all the above, is to complete the engineering design report (EDR) as evolved from the TDR of 2013. The EDR represents the "technical drawings" for actual construction of the ILC and is also expected to serve as the critical material to be evaluated in some countries in the context of formal project approval.

- On the basis of sufficient positive understanding of relevant government agencies, the project proposal will be brought to the table of top level interactions among relevant nations, such as G8 or else at some point during pre-ILC. This marks the formal initiation of the international negotiation process. Hopefully the site evaluation process in IL-2 would have progressed to an adequate stage to be connected to it by this time. If the leaders of the relevant nations agree to formulate an international treaty for the undertaking of the ILC, at this stage, the organization model may be switched to Model-3.

1.2 Desired process for establishing the top-level management structure

1.3 Issues that require consensus by the research community before the formal inter-government-level process starts.

1.4 On legal aspects

1.5 Possible Timeline of the Organizational Evolution

2. Siting - Site Selection Process (IL-2)

2.1 Critical Considerations

A critical requirement for our site selection is that this process converges to a site which is truly suitable for construction and operation for the ILC from the technical and scientific viewpoints. Therefore, the technical requirements for prospective sites must be drafted primarily on the basis of scientific considerations provided by the scientists and engineers and must be respected throughout the site selection process. A situation to avoid is inter-mixing of political and technical debates which lock up the site selection process in ways to compromise the smooth execution of the ILC project, leading to break-up of the cooperative relationship of the parties involved.

We have performed a pre-study on issues related to the site selection under the following principal logics:

1. All site candidates to consider should have completed a level of studies similar to those conducted during the time of TDR. They do not necessarily have to be explicitly cited in TDR, however.

2. Technical criteria should be established through consultation within the scientific community, and be practically frozen prior to the launch of inter-governmental site selection processes.

3. Technical judgment (i.e. non-political judgment) of adequacies of individual site proposals should be conducted by experts of accelerator construction, and be dictated by “clearance of critical criteria” rather than by “comparison of total scores”.

4. Cost differentials in conventional facilities and material transportation due to varying circumstances of individual sites should be borne by the host country / region. Such costs should be counted outside the scope of the total “common project” cost to share together by the hosting and non-hosting participating parties.

Examples of site selection processes, which apparently give some useful insights in the related issues, include those of the Olympic Games and the International Thermonuclear Engineering Reactor (ITER) project. The ITER site selection has managed a long and difficult site selection process, leading to the presently active efforts in Cadarache. The Olympics host selection process is a sophisticated one which has grown and refined over the years, and which has been successfully executed every four years. Table 2-1 summarizes the siting process for ITER and Olympic cases.

In our opinion it is of the utmost importance to evaluate and establish the site criteria on the basis of scientific considerations through a systematic analysis of requirements for the successful construction and operation of the ILC. We recommend that ILCSC leads the effort to establish such a site criteria guideline. This site criteria guideline and subsequent validation process of prospective sites from the technical standpoint, will establish a set of site candidates all of which are ensured to satisfy the scientific and technical site requirements for the ILC.

The validation process should start from an initial peer review in the TDP2 duration along the site criteria guideline looking carefully into the latest design studies on sample sites as characteristic representatives. The “pre-validated” candidates be designed in detail and required to complete equally up to TDR-level. The candidate sites designed in detail would follow a next level review by scientists and engineers including ones outside of the ILC communities in order to ensure the technical solidity and also adequacy of the research environment including supports by local governments, access and living environment. In these validation processes, careful consideration and control at the level of ILCSC should be made on how to publicize the actual places and routs of the candidates.

Government-level negotiations to follow, if they are made with respect to these "validated" site candidates, will result in the site which is technically suitable for the ILC, wherever it goes.

Table 2.1: Summary of the Site Process for ITER and Olympic

Site Selection Case Studies

	Olympic	ITER	ILC - Possibility
Stream	Staged approach: "**Application phase**" for pre-selection and "**Candidate phase**" for hearing, down-selection and voting.	Nation-level down-selection, followed by ITER Negotiation's meeting.	Possibly a staged approach: **"Phase 1" for scientific / technical validation**, followed by **"Phase 2" for government-level negotiations.**
Criteria for evaluation prior to final selection	Detailed questionnaire set and evaluation methodology by IOC.	http://www.naka.jaea.go.jp/ITER/official-J/pdfs/sitereq.pdf	Technical criteria can be established under ICFA/ILCSC.

Separation of "technical validation" and "final political selection" is important.

2.2 Possible Scenario toward Site-Selection

Assessment process of the site candidates should be fully controlled by ICFA/ILCSC with the inputs and checks by accelerator and CFS experts of GDE and detector groups under Research Director. Currently a sub-WG (ILCSC Siting sub-WG)[3] is responsible in ILCSC for the site related issues.

A possible scenario for the technical aspects of the site selection process is sketched. Four major steps, A, B, C and D are considered to take place in time order. For each of the major steps, A B, C and D, the expected deliverable out of the activity and the timescale are indicated. For each of the substeps, indicated as [1], [2], [3] …, the bodies to take actions or conduct the work are indicated, together with what to happen. Figure 2-1 shows the schematic timeline indicating each substeps: Figure 2-2 shows schematic drawing of time-wise evolution of the groups organized for the site related issues along the scenario described below.

.[3] Present members of this sub-WG include: P.Oddone (FNAL), J.Minch (DESY) and A.Suzuki (KEK).

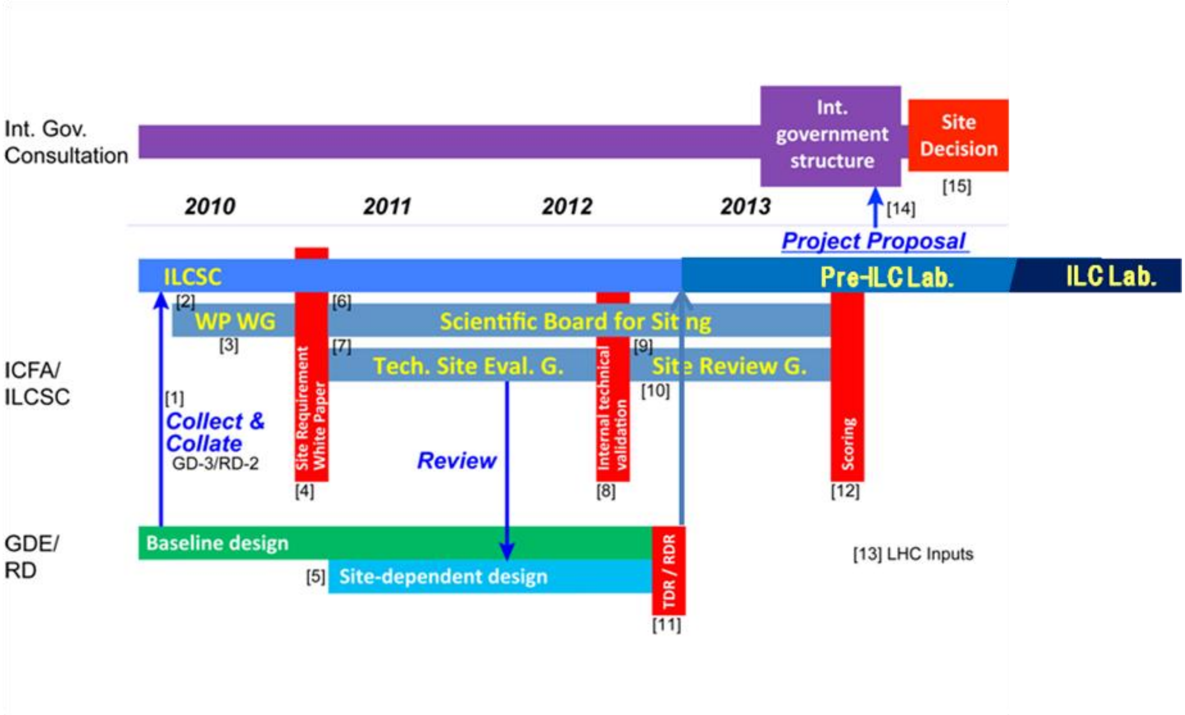

Figure 2-1: Timeline related to siting issues described in this document.

A. *Clarification of the technical requirements and desirable features for the ILC site from the scientific and technical standpoint.*

Deliverable: "Site Requirements" to be described in White Paper.

Timescale: by the end of 2010.

This may be done in the following steps:

[1] ICFA/ILCSC : Collect and collate the results from work packages GD-3 and RD-2. GD-3 and RD-2 are as listed in the CDPG work list, and would analyze the requirements for the prospective ILC site from technical and living-environment perspectives. See Appendix A of this document for more description. **Table.2-2** shows an example list of items to be summarized as required conditions for the site candidates.

[2] ICFA/ILCSC : Create the "Site Requirement WG", consisting of experts drafted from the ILCSC siting sub-WG and the GDE's CFS group, for refining and documenting the requirements from the technical view points for site to be candidates, to be described in the White Paper as Site Requirement.

[3] Site Requirement WG : Draft the "Site Requirement" to be described in White Paper on the basis of the material collected in Step 1, and by making clarifications and expert verifications on (i) requirements and desirable features of the site candidates, (ii) required site studies and investigations to perform at the time of TDR, (iii) schedule.

[4] ICFA/ILCSC: Apply editorial or refinement, if necessary, to the draft and publish the "Site Requirement" as a part of the White Pater. If precise numbers are not available for some items at the process in time, rough standard values with possible variation range would be enough.

B. *Execution of site studies during TDP2, validation of site cases with respect to the "Site Requirement" in White Paper and publication of TDR which contains descriptions of "technically validated" site-specific designs.*

Deliverable: "TDR including descriptions technically-validated site-specific ILC CFS designs". ILCSC must carefully control how to describe the site-dependent designs in TDR to be created by GDE, considering which information be publicized, which may lead identification by general public of the actual place and rout of the candidate site.

Timescale: by the end of 2012.

This may be done in the following steps:

[5] GDE CFS Teams: Conduct site-dependent design studies in accordance with the "Site Requirement" in White paper

[6] ICFA/ILCSC: Create the "Scientific Board for Siting", with members drafted from the ILCSC Siting sub-WG. The Scientific Board for Siting is the highest scientific body to direct the studies and evaluations of the technical and legal issues pertaining to the ILC site selection process. Timescale: early in 2011

[7] Scientific Board for Siting : Create the "Technical Siting Evaluation Group for TDR" (TSEG). This is an expert group which consists of members drafted from PAC and experts on geology and civil engineering. Timescale: early in 2011

[8] TSEG: "Validates" the site candidates to be discussed in the TDR, on the basis of the features of such sites as known at that stage, in the light of the "Site Requirement" in White Paper. TSEG will conduct due evaluation processes by making interviews, review meetings, site tours and others, as deemed necessary. TSEG reports the results to TSEG. The validated site cases are the ones to be discussed in TDR (non-validated site cases would not enter TDR). This ensure that the site cases as discussed in the TDR are known to satisfy the requirements as set forth in the "Site Requirement" in White Paper. The criteria and the operational principles of the validation process are subjects of further studies.

C. *Technical Review and Assessment of for the candidate sites that are discussed in the TDR.*

Deliverable: Scoring of the candidate sites discussed in the TDR from the technical and scientific standpoint.

Timescale: ~2013.

[9] Siting Advisory Board: Creates a "Site Review Group" (SRG). SRG consists of members as drafted from the PAC, experts of geology and civil engineering, highly-regarded external experts. The mission of SRG is to conduct systematic scoring of the site candidates as discussed in the TDR. The group would be formed

before finalization of the TDR, in order to pre-study the contents of TDR and pre-define the method of the assessment. The methodology for the scoring and its specific contents are issues to be studied.

The process needs attention to ensure the fair and transparent assessment. For instance, in the case of ITER, separated two sub-groups have been formed, one to define the method and priority or weights for the assessment and another to actually assess along the method. Such consideration should also be applied for the case of ILC, forming two sub-groups in SRG.

[10] SRG : Conduct preliminary studies and examination of the site-specific studies as given in the TDR.

[11] GDE/RD：Publication of TDR and DBD.

[12] SRG : Conduct assessment of the site cases which are presented in the TDR. We might adopt a scoring process which resembles that of the “First-phase selection of the next Olympic game” (see Fig 2-3). The Evaluation would be made by SRG not only for the technically indispensable features but also for the adequacy to the desired features as the research environment including supports by local governments, legal aspects, access and living environment. (see also Table 2-3) Details of this process and the scoring matrix are subject of further discussion elsewhere.

D. Process of narrowing-down the site candidates through an inter-governmental level consultation, including discussions on general political aspects

[13] Final optimization of the energy and luminosity specifications of the ILC, on the basis of results from LHC and other considerations such as those on the cost. TDR may be re-refined with this optimization and with it, a project proposal could be submitted to relevant governments. Hopefully this triggers creation of a forum for international negotiation which is led by representatives of relevant governments with consultation with leading scientists.

[14] The forum for international negotiation, as set forth in 13, creates an international panel for evaluating and recommending the choice of the ILC site. In this process, the most important condition to be evaluated as the candidates is that the candidate sites, which must have passed through the technical and scientific evaluation processes described above, be supported and proposed by the corresponding government-level official body. Since the technical aspects have been already assessed and ensured for the remaining candidate sites, main task of the international panel would be i) to officially confirm the process and justification made by the scientists and engineers in the process 1—12 mentioned above and modify if necessary, ii) checking further concrete legal aspects, and iii) summarize the pros and cons for the individual candidate site officially proposed.

[15] Decision on the site: As seen in the case of ITER, the final decision would be made in the inter-governmental high-level negotiation, from the view points of national and inter-national policy including the share of the construction/operation cost, international structure of the ILC organization (disucss in IL-1).

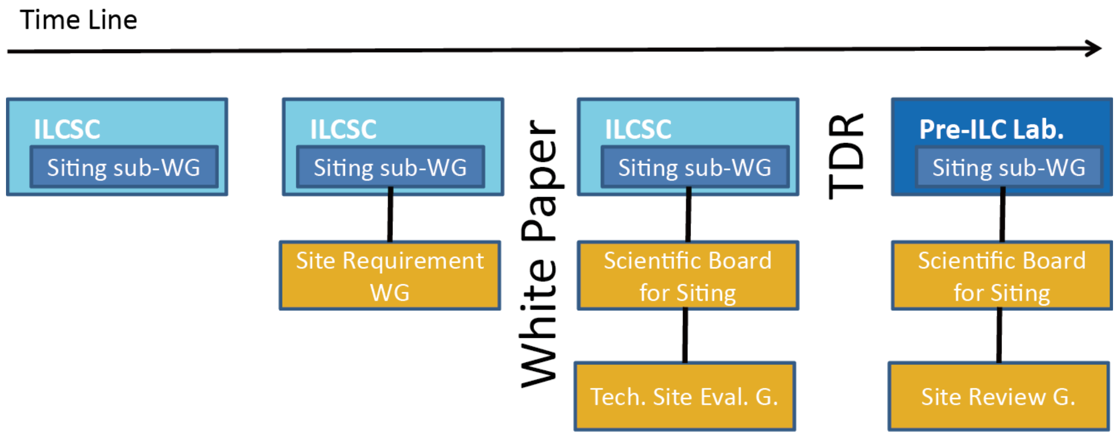

Figure 2-2: Schematic drawing of the evolution of the groups organized for the site related issues along the scenario described in this document.

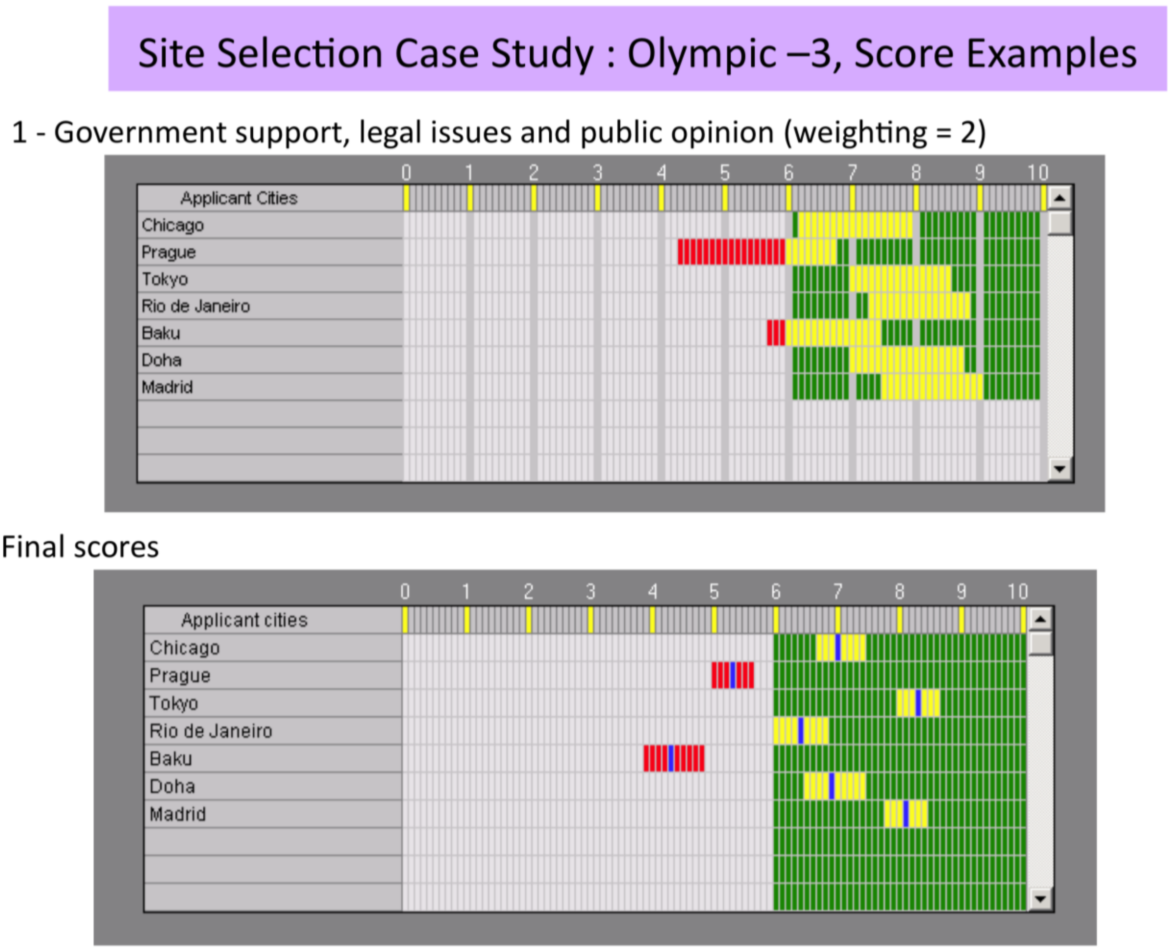

Figure 2-3: First-phase selection of the next Olympic game.

Table 2.2: Example items for the Site requirement.

Items		KCS	DRFS	Supplier
Land				
Length of acc. tunnel		31km/50km		ILCSC
Transport to the site	maximum weight, size to be shipped	liquefier, cryomodule, solenoid, calorimeter	liquefier, cryomodule, solenoid, calorimeter	GDE
Installation route	maximum weight, size to be installed	cryomodule, solenoid, calorimeter	liquefier, cryomodule, solenoid, calorimeter	GDE
Land Area	accelerator facility	5 RF cluster buildings, access tunnel for the interaction point	cooling facilities, access tunnel for the interaction point	GDE
Surface area	research building, office	office space, welfare facility for more than 2,000 employees		RD
Grand vibration	ML,DR,BDS	upper limit for power spectrum (reference value)		GDE
Grand motion	long-term shift	dynamic range of alignment mechanism		GDE
Seismic characteristics	maximum acceleration	peak acc. of xx gal（or/and amplitude of xxx） should not be expected		GDE
		return period of peak acc. of xx gal（or/and amplitude of xxx） should be > years		GDE
		return period of peak acc. of xx gal（or/and amplitude of xxx） should be > years		GDE
active faults		no active faults traverse the land area		GDE
geotechnical characteristics		should not affect construction and maintenance		GDE
cooling water		m^3/day	m^3/day	GDE
sump water capacity		maximum capacity	maximum capacity	GDE
Electrical power				
	High voltage power line	not specified		GDE
	capacity for power load	230MW?	230MW?	GDE
	stability of frequency	not specified?		GDE
	stability of power voltage	not specified?		GDE
	stability of power grid	should not affect nearby power grid		GDE
	power faults			
		no power fault of t > xxxx hours		GDE/RD

		# of power faults of t > xxx min has to be e less than xxx	GDE/RD
		# of power faults of t > xxx sec. has to be e less than xxx	GDE/RD
Environmental conservation	protected materials	no protected animals, flora, historical heritages	RD
Meteorological Characteristics			
	Max. air temperature	not specified, but should not interfere cooling capability	
	Min. air temperature	not specified, but should not interfere lab. operations	
	mean air temperature	not specified, but it will be an issues for cooling efficiency	
	mean annual rain fall	not specified, but it will be an issues for cooling efficiency	
	max. monthly rain fall	not specified, but should be within water drain capability	
	max. snow fall	not specified, but should not affect construction works	
	max. snow load	not specified, but should not affect construction works	
Transport infrastructure			
Highway	highway transport to port, airport, commercial area	not specified	
Air port		not specified,	
Road		capable for transporting equipments of max. weight, max. height, max. width	
Landing port	wharf machinery	capable for transporting equipments of max. weight, max. height, max. width	
Research infrastructure			
	skilled and unskilled labor	will be supplied from nearby society (at the time of construction and operation)	
	industrial and scientific service	will be supplied from nearby society (at the time of construction and operation)	
Acceptance of local government		compulsory	
Socioeconomic Infrastructure			
	near by city	major city of population of xxx is desirable in xxx hours	
	public safety	highly desirable	
	economic stability	highly desirable	
	dwellings	houses, apartments, dormitories for population of more than 5000	
	international schools	kindergarten to secondary schools are compulsory after construction phase	
	medical facilities	compulsory	
	fire department	compulsory	

	police	compulsory	
	job opportunities for spouses and other relatives	desirable	
	support for foreign researcher, family	not specified. The ILC lab. should have a department to support foreign researchers and their families	

Table 2-3: Examples of the items to be evaluated by the process-B (by TSEG) and process-C (by SRG) under the coordination of Scientific Board for Siting.

Examples of site requirements.
The "v" marks under TSEG (Technical Site Evaluation Group for TDR) and SRG (Site Review Group on TDR) indicate that these groups evaluate these items.
The "Comprehensive assessment" will assess all items.

Items	Requirements (for KCS or DRFS)	TSEG	SRG
Land			
Length of acc. tunnel		v	v
Transport to the site	Maximum size and weight to be shipped	v	v
Installation route	Maximum size and weight(acc. and det.)	v	v
surface land area	facilities for accelerator	v	v
ground vibration	DR,ML,BDS, natural and artificial	v	v
geotechnical characteristics		v	v
water supply		v	v
sump water capacity		v	v
Seismic characteristics	max. acceleration and return period	v	v
Land area	Cooling facilities, RF facilities, Campus facilities	v	v
Electrical power			
	capacity for power load	v	v
	power system stability	v	v
	impact on power grid	v	v
Meteorological Characteristics	air temperature, etc	v	v
Environmental conservation	protected animals, flora, historical heritages	v	v
Research Infrastructure	labor, industrial and scientific services	v	v
Acceptance of local government		v	v
Socioeconomic Infrastructure			
expected population	construction		v
	operation		v
	special instruction for import and export		v
	special instruction for Visa		v
	cultural life in a cosmopolitan environment		
	public safety		
	dwellings		v
	international schools		
	Hospital, clinics		
	job opportunities for spouses and other relatives		
	support for foreign researcher, family		

3. Sharing Models (GD-1)

[Editorial Notes:
Sharing Models.

Assignment: GDE.

This WP deals with the sharing models for the responsibilities in the technical aspects of construction, operation and maintenance of the ILC. The mission of GD-1 is to identify the suitable models for how to share these responsibilities in a manner that the ILC is built, commissioned and operated on time within budget, assuming that the site selection is suitably made. The proposed contents of the studies include the following:

(1) Identified list of equipment to be shared, as in-kind contributions by participating parties or as procurement made with the common fund.
(2) Identified list of additional contributions to expect from the hosting country / region.
(3) Procurement and sharing of human resources, such as: personnel from local labs, remote labs, seconded personnel and others.
(4) Analysis of possible "models of sharing" from technical viewpoint, in particular, with regards to suitable fractions of in-kind-type and common-fund-type contributions at various stages of the project execution.

]

4. Management Models on Accelerator and Facilities (GD-2)

[Editorial Notes:
Management Models on Accelerator and Facilities.

Assignment: GDE.

This WP deals with the specifics of desirable management model (or models) of technical aspect of construction, commissioning and operation of the ILC under the top-level management as laid out in IL-1 / GD-0. The proposed contents of the studies include an analysis of the requirements in the management and possible solutions for the activities both on-site and off-site for:

(1) Pre-construction period.
(2) Construction period.
(3) Commissioning period.
(4) Operation period.
]

5. Siting - Technical (GD-3)

[Editorial Notes:
Siting – Technical.

Assignment: GDE.

This WP deals with technical analysis of the site specifications to specify and site studies to perform for the site selection process as an input to IL-2. It is noted that the aspects of site requirements pertaining to living conditions for the laboratory staff will be dealt with in a separate WP, RD-2. It is also noted that the high-level issues related to the site-selection process is a subject of IL-2. The proposed contents of the studies include analyses and, if necessary, the proposed work flows on the following topics:

(1) Site specifications, from the aspects of: geological and geographical standpoint; transportation of the equipment; electricity, water and other resources.
(2) Site studies to perform, during the pre-approval / pre-construction stages of the ILC.
(3) Environmental assessment to perform for each of the candidate sites and its process.

]

6. Accelerator Construction Process - Design Preparation Stage (GD-4)

[Editorial Notes:
Accelerator Construction Process – Technical.

Assignment: GDE.

This and the next two WPs deals with a group of timeline analyses for the construction steps to follow for the ILC accelerator and related facilities. The proposed contents of the studies include the following:

- GD4: Design preparation stage – Finalization of the accelerator design, and advanced manufacturing studies.
- GD5: Construction stage – Steps to follow in component fabrication, component installation and commissioning.
- GD6: Schedule for conventional facilities – Steps to follow in tunnel excavation and construction of surface facilities.

]

7. Accelerator Construction Process - Construction Stage (GD-5)

8. Accelerator Construction Process - Conventional Facilities (GD-6)

9. Management Model on Detectors and Experiments (RD-1)

[Editorial Notes:
Management Model on the Detectors and Experiments.

Assignment: RD.

This WP represents the Detector / Experiment counterpart for GD-2, and deals with the specifics of desirable management model (or models) of technical aspect of construction, commissioning and operation of the ILC detectors, under the top-level management as laid out in IL-1 / GD-0. The proposed contents of the studies include an analysis of the requirements in the management and possible solutions for the activities both on-site and off-site for:

(1) Pre-construction period.
(2) Evaluation and approval process of the experimental proposals.
(3) Construction period.
(4) Commissioning period.
(5) Operation period.
]

10. Siting - Living Environment (RD-2)

[Editorial Notes:
Siting - Living Environment.

Assignment: RD.

This WP represents a part of the site criteria which is more closely related to the living environment for the personnel, both stationed as the personnel at the host and as visitors. The coverage of RD-2 supplements that of GD-3. The proposed contents of the studies include an analysis of the following issues and possible solution model(s):

(1) Access.
(2) Residential environment.
(3) Employment situations for family members.
(4) Communal facilities, such as schools, accommodations, hospitals, conventional halls, religious installations and like.
(5) Climate / weather.
]

11. Detector Construction Process - Design and Preparation Stage (RD-3)

[Editorial Notes:

Detector Construction Processes – Technical.
Assignment: RD.
This and the next two WPs represent the RD counterpart of the WPs GD-4, 5, 6, and deals with a group of timeline analyses for the construction steps to follow for the ILC detectors and experiments. The proposed contents of the studies include the following:

- RD3: Design preparation stage – Finalization of the accelerator design, and advanced manufacturing studies.
- RD4: Construction stage – Steps to follow in component fabrication, component installation and commissioning.
- RD5: Schedule for conventional facilities – Steps to follow in tunnel excavation and construction of surface facilities.

]

12. Detector Construction Process - Construction Stage (RD-4)

13. Detector Construction Process - Conventional Facilities (RD-5)

Appendix A: CPDG Outline

Discussion on CPDG of the International Linear Collider naturally involves a wide range of issues which span across: the project governance structure, site selection process, technical design, construction, commissioning and operation. The structure of these issues may be schematically laid out as per Figure A1.

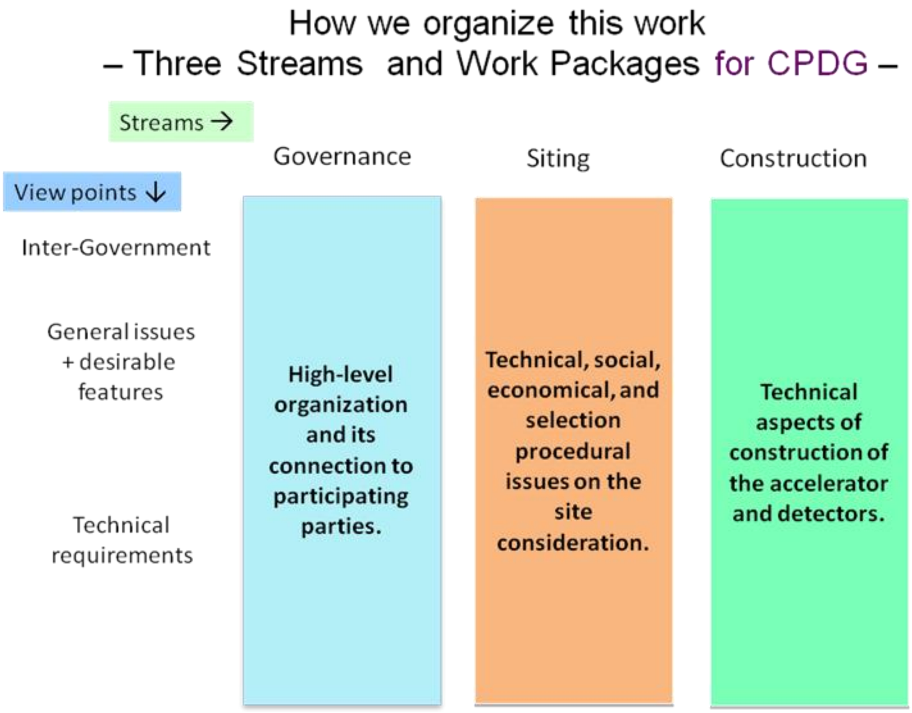

Figure A1:

In the analysis of specific issues and for development of organizational solutions together with executions plans, many of them will require involvement of various parties with expertise on engineering, scientific, managerial, administrative and political aspects. Also, while the issues presented in Figure A1 are very broad and somewhat abstract, it is easily envisaged that there would be heavy inter-dependence or even cyclic-dependence among them. Recognizing this complex nature of CDPG, yet in order to best take advantage of the existing expertise in our community, we propose to break up the issues to address in approximately a dozen or so work-packages (WP).

Figure 2A shows the proposed break-up. Brief descriptions of the WPs and proposed assignments follow. Naturally, some synthetic work is needed by ICFA/ILCSC, after collecting all the results of the studies, before putting them into a single document. However, pre-defining the nature of individual issues and identifying the experts to address them are expected to help us streamline the synthesis as well as the interactions required during the effort by the groups addressing each of the WP items.

IL-0: This is the introduction to our CPDG, giving executive, guiding statements on the general philosophy to maintain throughout creation, operation and management of the ILC laboratory. Assignment: ICFA chair and ILCSC chair. This section is expected to incorporate some statements on:

(1) the required openness to the world
(2) solid legal base, long-term stability

(3) short-term agility of the organization
(4) evolutionary steps to follow when the ILC lab is being approved and formed and
(5) some notes on intellectual properties and the short- and long-term health of participating HEP institutions.

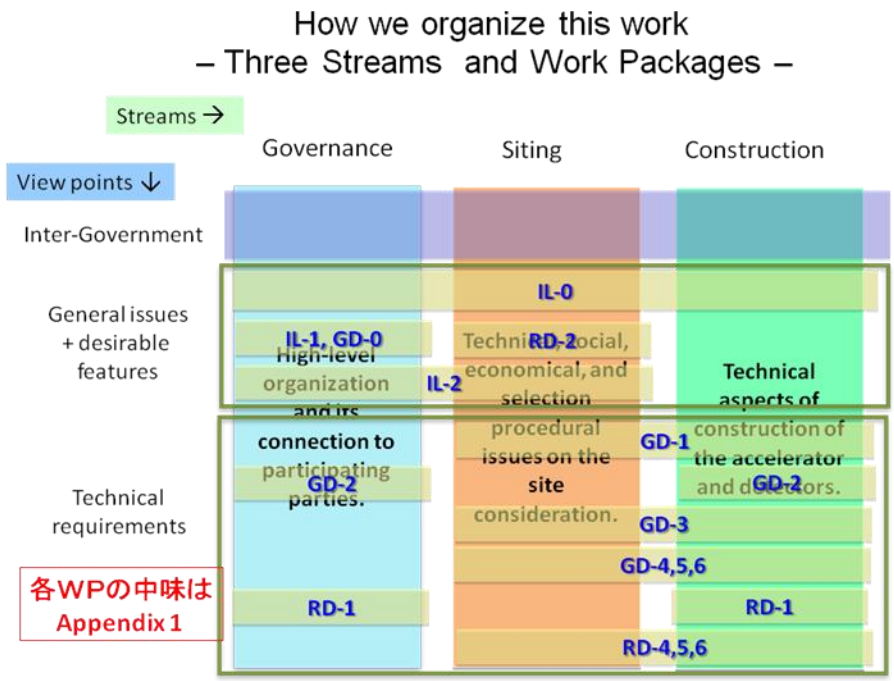

Figure A2:

IL-1, GD-0: Analysis and Proposal for the Top-Level Management. Assignment: ICFA/ILCSC (IL-1) and GDE (GD-0). This WP deals with analysis and proposals for the organizational structure of the *top-level* governing body, and its relation to collaborating institutions and participating nations. ICFA/ILCSC and GDE are expected to study this WP in parallel, and their results later synthesized. Proposed contents of the work include:

(1) Assessment of possible example models such as CERN, ITER, EuroXFEL etc and recommendations to be extracted from them,
(2) Desired process for establishing the top-level management structure.
(3) Issues that require consensus by the research community before the formal inter-government-level negotiations ensues.
(4) Comments on some legal aspects, such as intellectual and material property rights, safety regulation issues, taxes, legal status of the organization and its members.

IL-2: Site Selection Process. Assignment: ICFA/ILCSC. This WP deals with the general analysis of the top-level issues of the site selection process with statements on our preference from the scientists' viewpoint. We note that the technical specifications for the site criteria are to be separately examined in GD-3 and RD-2. We also note that the actual final site selection is a process left for the inter-government level negotiations. The mission of IL-2 is to extract and present the general philosophy to prevail throughout these efforts from the top-level scientific viewpoint. The proposed contents include the following:

(1) Studies of past (or ongoing) site selection processes, such as those for ITER, Olympics, etc.
(2) Desirable features of the site selection process for ILC.
(3) Studies of the ILC site cases on the basis of GD-3 and RD-2.

GD-1: Sharing Models. Assignment: GDE. This WP deals with the sharing models for the responsibilities in the technical aspects of construction, operation and maintenance of the ILC. The mission of GD-1 is to identify the suitable models for how to share these responsibilities in a manner that the ILC is built, commissioned and operated on time within budget, assuming that the site selection is suitably made. The proposed contents of the studies include the following:

(1) Identified list of equipment to be shared, as in-kind contributions by participating parties or as procurement made with the common fund.
(2) Identified list of additional contributions to expect from the hosting country / region.
(3) Procurement and sharing of human resources, such as: personnel from local labs, remote labs, seconded personnel and others.
(4) Analysis of possible "models of sharing" from technical viewpoint, in particular, with regards to suitable fractions of in-kind-type and common-fund-type contributions at various stages of the project execution.

GD-2: Management Models on Accelerator and Facilities. Assignment: GDE. This WP deals with the specifics of desirable management model (or models) of technical aspect of construction, commissioning and operation of the ILC under the top-level management as laid out in IL-1 / GD-0. The proposed contents of the studies include an analysis of the requirements in the management and possible solutions for the activities both on-site and off-site for:

(1) Pre-construction period.
(2) Construction period.
(3) Commissioning period.
(4) Operation period.

GD-3: Siting – Technical. Assignment: GDE. This WP deals with technical analysis of the site specifications to specify and site studies to perform for the site selection process as an input to IL-2. It is noted that the aspects of site requirements pertaining to living conditions for the laboratory staff will be dealt with in a separate WP, RD-2. It is also noted that the high-level issues related to the site-selection process is a subject of IL-2. The proposed contents of the studies include analyses and, if necessary, the proposed work flows on the following topics:

(1) Site specifications, from the aspects of: geological and geographical standpoint; transportation of the equipment; electricity, water and other resources.
(2) Site studies to perform, during the pre-approval / pre-construction stages of the ILC.
(3) Environmental assessment to perform for each of the candidate sites and its process.

GD-4, 5, 6: Accelerator Construction Process – Technical. Assignment: GDE. This WP deals with a group of timeline analyses for the construction steps to follow for the ILC accelerator and related facilities. The proposed contents of the studies include the following:

GD4: Design preparation stage – Finalization of the accelerator design, and advanced manufacturing studies.
GD5: Construction stage – Steps to follow in component fabrication, component installation and commissioning.
GD6: Schedule for conventional facilities – Steps to follow in tunnel excavation and construction of surface facilities.

RD-1: Management Model on the Detectors and Experiments. Assignment: RD. This WP represents the Detector / Experiment counterpart for GD-2, and deals with the specifics of desirable management model (or models) of technical aspect of construction, commissioning and operation of the ILC detectors, under the top-level management as laid out in IL-1 / GD-0. The proposed contents of the studies include an analysis of the requirements in the management and possible solutions for the activities both on-site and off-site for:

(1) Pre-construction period.
(2) Evaluation and approval process of the experimental proposals.
(3) Construction period.
(4) Commissioning period.
(5) Operation period.

RD-2: Siting - Living Environment. Assignment: RD. This WP represents a part of the site criteria which is more closely related to the living environment for the personnel, both stationed as the personnel at the host and as visitors. The coverage of RD-2 supplements that of GD-3. The proposed contents of the studies include an analysis of the following issues and possible solution model(s):

(1) Access.
(2) Residential environment.
(3) Employment situations for family members.
(4) Communal facilities, such as schools, accommodations, hospitals, conventional halls, religious installations and like.
(5) Climate / weather.

RD-3, 4, 5: Detector Construction Process – Technical. Assignment: RD. These WPs represent the RD counterpart of the WPs GD-4, 5, 6, and deals with a group of timeline analyses for the construction steps to follow for the ILC detectors and experiments. The proposed contents of the studies include the following:

RD3: Design preparation stage – Finalization of the accelerator design, and advanced manufacturing studies.
RD4: Construction stage – Steps to follow in component fabrication, component installation and commissioning.
RD5: Schedule for conventional facilities – Steps to follow in tunnel excavation and construction of surface facilities.

Appendix B: Comparison of Organizational Models

A survey was made on organizational models in high-energy physics and related field of science where significantly large international collaborations were actually managed. Through some iterations, a number of “points of comparison” were extracted and accordingly, a comparison table was created to summarize the features, benefits and issues pertaining to these models. The models presented in this table, for illustration purposes, include CERN (with emphasis on LHC), ITER and possible organizational forms for the ILC.

		LHC (CERN)			ITER			ILC		
			Host issues	Guest issues		Host issues	Guest issues		Host issues	Guest issues
Structure and Relations among Top Level Forums during Project Inception	With respect to individual governments	(On CERN rather than on LHC) At an intergovernmental meeting of UNESCO in Paris in December 1951, the first resolution concerning the establishment of a European Council for Nuclear Research was adopted. Two months later, 11 countries signed an agreement establishing the provisional Council – the acronym CERN was born. http://public.web.cern.ch/public/en/About/History54-en.html			US-USSR Summit Meeting in 1985 was the starting point.The formal inter-governmental negotiation for drafting the Agreement on Joint Implementation of the ITER Project (the ITER Agreement) and for selection of the ITER construction site began in 2001 with participation of Japan, EU, Russia, and Canada. USA, China, Korea rejoined ITER negotiations in 2003. Canada withdrew in the same year. India joined ITER negotiations in 2005. 7 Signatories have engaged themselves to the preparatory works for ITER construction consistent with their relevant domestic laws and regulations according to the Arrangement of the Provisional Application of the ITER Agreement. http://www.mofa.go.jp/policy/treaty/submit/session166/agree-3.pdf			As an exercise the following possibilities are considered for the ILC laboratory: OP-1: A new ILC-lab on the basis of an international agreement like the one for CERN: material procurement is done mainly via common fund under management of the ILC-lab. OP-2: Limited liability company which operates the new ILC-lab, and this company contracts out certain tasks to existing lab(s) for materials procurement and construction: thus, material procurement is done mainly via in-kind contributions (Company + in-kind). OP-3: A new ILC-lab on the basis of an international agreement like the one for ITER: material procurement is done mainly via in-kind contributions. OP-4: A new ILC-lab on the basis of institution-level MoUs to create a joint managerial body for the ILC (multi-national lab). Material procurement and construction is supported by combination of in-kind contributions and common fund. Depending on the project stage, the host country / region may need to support larger part of procurement at that point.		
	With respect to (higher level) international organizations	(On CERN rather than on LHC) At the fifth UNESCO General Conference, held in Florence in June 1950, where the American Nobel laureate physicist, Isidor Rabi tabled a resolution authorizing UNESCO to "assist and encourage the formation of regional research laboratories in order to increase international scientific collaboration…" http://public.web.cern.ch/public/en/About/History54-en.html			Organized by IAEA. The IAEA has been actively involved in the ITER project from its inception, providing its auspices and practical support, including publication of technical documents and ITER Newsletter. http://www-naweb.iaea.org/napc/physics/iter/ITER.htm http://www-naweb.iaea.org/napc/physics/accelerators/pa.htm			Op-1: a UN organization such as UNESCO, IAEA... to acknowledge / authorize the formation of a new lab. OP-2: Not directly connected to specific international organizations. Op-3: a UN organization such as UNESCO, IAEA... to acknowledge / authorize the formation of a new lab. OP-4: For instance, a regional organization such as Asian Free Trade Association, ASEAN might acknowledge / authorize the formation of a new lab.		
Structure and Relations among Top Level Forums during Project Construction and Operation	With respect to individual governments	Government voices are reflected via CERN Council: The Council is composed of not more than two delegates (typically, government representative and scientist) from each Member State who may be accompanied at meetings of the Council by advisers. http://dsu.web.cern.ch/dsu/ls/conventionE.htm			via Domestic Agencies: Seven Members of the international ITER project have all created Domestic Agencies to act as the liaison between national governments and the ITER Organization. The Domestic Agencies' role is to handle the procurement of each Member's in-kind contributions to ITER. The Domestic Agencies employ their own staff and have their own budget, and place contracts with suppliers. They are responsible for organising and carrying out the procurement for each ITER Member. http://www.iter.org/org/Pages/DAs.aspx http://www.iter.org/org/Pages/default.aspx			Op-1: Via ILC Council: The Council may be composed of delegates from each Member State who can be accompanied at meetings of the Council by advisers. OP-2: Each government becomes a shareholder of the Limited liability company. Their labs may assist the gov representives in the share holder's meeting. Op-3: Via the participating labs. OP-4: Via the rep of the member-lab branches in the Council which is established via inter-lab MoU. Each lab then reports to respective government agencies.		
	Top-level governing body	CERN Council: CERN is run by 20 European Member States, each of which has two official delegates to the CERN Council. One represents his or her government's administration; the other represents national scientific interests. Each Member State has a single vote and most decisions require a simple majority, although in practice the Council aims for a consensus as close as possible to unanimity. http://dsu.web.cern.ch/dsu/ls/conventionE.htm			ITER Council:The ITER Council is comprised of four representatives per ITER Member. The Chair and Vice-Chair of the Council are elected from amongst the Members and can hold office for up to four years. Meetings are held at least twice a year; a communiqu é is issued to the press after each meeting...... http://www.iter.org/org/Pages/Council.aspx http://www.iter.org/org/Pages/default.aspx http://www.iaea.org/Publications/Documents/Infcircs/2007/infcirc702.pdf			OP-1: Council of the host lab. Council will be composed of delegates from each member state. OP-2: ILC-Enterprise Council composed of delegates from the shareholders. OP-3: ILC-Lab. Council composed of delegates from the participating labs. OP-4: Host lab. Council which includes representatives of member-lab branches.		
	With respect to (higher level) international organizations	In cooperation with UNESCO. Can extend coorperation with other international orgs with council approval with > 2/3 votes. http://dsu.web.cern.ch/dsu/ls/conventionE.htm UNESCO plays the role of the depositary of the protocol... See articles 23-27 of the CERN protocol: https://hr-services.web.cern.ch/hr-services/Ben/tax/Docs/PROT-FIN-SIGNE-			IAEA: The Director General of the IAEA shall be the depositary of the Agreement…. See article 29 of the ITER Agreement: http://www.mofa.go.jp/policy/treaty/submit/session166/agree-3.pdf			Op-1: a UN organization such as UNESCO, IAEA, etc. OP-2: Not directly connected to specific international organizations. OP-3: a UN organization such as UNESCO, IAEA, etc. OP-4: It may be connected to some regional organization such as Asian Free Trade Association, ASEAN, etc.		

	Legal basis	"ARTICLE IX : Legal Status" states as follows - The Organization shall have legal personality in the metropolitan territories of all Member States. Set up as practically a permanent organization. See "ARTICLE XIV: Dissolution", which says "The Organization shall be dissolved if at any time there are less than five Member States. It may be dissolved at any time by agreement between the Member States." http://dsu.web.cern.ch/dsu/ls/conventionE.htm			Legal basis is the inter-governmental agreement on the founding of ITER organization and related documents. Project for 35 yrs (10 yrs for construction, 20 yrs for operation and 5 yrs for decommissioning and decontamination). BA for 10 yrs. http://www.iaea.org/Publications/Documents/Infcircs/2007/infcirc702.pdf			Op-1:The new lab. shall have juridical personality in all membership countries based on an international agreement. OP-2: The new enterprise shall have juridical personality in the host country. Op-3: Same as Op-1. OP-4: The new lab. shall have juridical personality in the host country		
	Organizational structure	The CERN Council is the highest authority of the Organization and has responsibility for all-important decisions. It controls CERN's activities in scientific, technical and administrative matters. The Council approves programmes of activity, adopts the budgets and reviews expenditure. The Council is assisted by the Scientific Policy Committee and the Finance Committee. The Director-General, appointed by the Council, manages the CERN Laboratory. He is assisted by a Directorate and runs the Laboratory through a structure of Departments.			see http://www.iter.org/org/Pages/default.aspx http://www.iter.org/org/organization/org_chart_2010_01.jpg			Op-1: The Council is the highest authority of the Organization and has responsibility for all important decisions. The Director-General, appointed by the Council, manages the lab., assisted by a Directorate. OP-2: Same as Op.-1, except that the Council is the assembly of the shareholders. OP-3: Same as Op.-1, except that the Council is the assembly of the participating labs. OP-4: Same as Op.-1, except that significant part of the administrative body will be supported by the host country.		
	Admission of new participating parties	The Organization shall provide for collaboration among European States in nuclear research. States which are parties to the Agreement of the fifteenth of February, 1952, referred to in the Preamble hereto, or which have contributed in money or in kind to the Council thereby established and actually participated in its work, shall have the right to become members of the Orgnanization by becoming parties to this Convention in accordance with the provisions of Article			Possible upon unanimous approval by the counci. http://www.iaea.org/Publications/Documents/Infcircs/2007/infcirc702.pdf			Op-1: Possible upon approval by the council. OP-2: Same as Op-1. OP-3: Same as Op-1. OP-4: Same as Op-1.		
Management and Opertional Organization	Long-Term Stability	Maintained through members' obligations to finance continued, long-term contributions. Dissolution: The Organization shall be dissolved if at any time there are less than five Member States. It may be dissolved at any time by agreement between the Member States.			The seven participants are obliged to stay for 10 years. Withdrawal, after 10 years, is possible if certain decommissioning cost is borne.			Op-1: Maintained through members' obligations imposed by an international agreement to finance the project. It may be dissolved at any time by agreement between the Member States. OP-2: Maintained through contracts. Withdrawal is possible if certain decommissioning cost is borne. OP-3: Same as Op-1. OP-4: Maintained through strong commitment of the host and MOU among participating labs.		
	Flexibility with respect to organizational changes and technical challenges	Converntions can be revised by > 2/3 voting of the Council.			The work of the ITER Organization is supervised by its top body, the ITER Council. It has the authority to appoint senior staff, amend regulations, decide on budgeting issues, and allow additional states or organizations to participate in ITER. http://www.iter.org/org/Pages/Council.aspx			Flexibility in this regard is secured by maintaining certain leadership role on the part of the cerntral managerial body or of the host: Op-1: flexible by virtue of centralism based on common fund; the council governs all the procurements. OP-2: less flexible because of decentraliized system based on in-kind contributions; the council cannot fully control the procurements. OP-3: Same as Op-2. OP-4: Flexible due to the power centralized in the host.The council governs all the procurements.		
	Transparencies of decision making processes	Council reviews expenditures and approves and publishes audited accounts of the Organization. Council publishes annual report or reports. Council minutes are all puiblic.			ITER council has bodies for operation review and financial auditing. The council approves the annual accounts of the ITER Organization. The council adopts the annual reports.			Assuming the council includes both member states and observer states for all the options Op-1: Council reviews expenditures and approves and publishes audited accounts of the Organization. Council publishes annual report or reports. Council minutes are all public. OP-2: Same as Op-1. OP-3: Same as Op-1. OP-4: Same as Op-1.		
	Fairness to participating parties	Each Member State has a single vote and most decisions require a simple majority			Voting, for planning of experiments, is weighted in accordance with the cost sharing during operation.			Financial matters will be determined via voting with certain weighting in accordance with the relative amount of contributions. Scientific matters will be determined via technical / scientific discussion by members on more equal footing.		

	Relation with the users community	Public call for proposals followed by committee screening; then execution on the basis of MoU.				Do not apply				Public call for proposals for exps, followed by committee screening and final approval by the Council; Experiments are executed on the basis of their specific MoUs. Once approved, the experimental collaborations report to the lab, but are given certain autonomy. The collaborations are responsible for certain fraction of the operation cost of exp facility.		Issues of how the contributions to the operation of the accelerator facility are shared, and how they should be correlated with the magnitude of participation in the exp programs are to be examined and be figured out.	
		Construction	Operation			Construction	Operation			Construction	Operation		
Resource Procurement	Flow of funds and method of procurement of materials by the central lab.	Each Member State shall contribute both to the capital expenditure and to the current operating expenses of the Organization. The Council may determine a percentage as the maximum which any Member State may be required to pay of the total amount of contributions assessed by the Council to meet the annual cost of that programme	Same pratice as the entry on the left concerning the facility. Common fund for individual experiments is also maintained on the basis of specific MoUs.			Sharing of support during construction as per agreement.	??			OP-1: mostly common fund including (HW materials). OP-2: Combination of common fund (personel, management, installation), in-kind contributions (HW materials), and host support (CF/S). OP-3: Same as Op-2. OP-4: mostly common/host fund including (HW materials).	Through common fund from both participating parties in facility construction and experimental collaborations.	Note: We anticipate that contributions to the ILC lab will have to take forms of a mixture of "in-kind material" contributions, "common fund" and personnel. This fact is most likely independent of exactly what type of legal / organizational structure the ILC lab might have, although their relative weights may vary. The ILC lab will have to accommodate and manage them all.	
	In-kind contributions from participants	In-kind contributions in case of experiments.	Essentially none.			Procurement is done by DAs of individual participating parties as in-kind contributions, in accordance with PA (procurement agreement) defining the specifications of individual components and schedule.	?			OP-1: In-kind contributions in case of experiments. OP-2: in-kind contributions (HW materials). OP-3: Same as Op-2. OP-4: Same as Op-1.	In-kind contributions at this stage are unlikely to be a dominant element (need to check).		
	Human resources	Personnel from member countries : France (35%), UK (9.8%), Italy (9.5%), Germany (8.9%), Switzerland (7.8%), Spain (4.7%) and the rest (1% each).				Seven participants supply the personnel in accordance with procurement. The Domestic Agencies are the contact points for ITER Organization job postings.				Op-1: from member states. OP-2: from shareholders. OP-3: from participating labs. OP-4: Mostly from the host.	The personel in the construction phase plus the personel from the user community.		
	(Outsourcing / On-site Staff)	2663 Staff members (with 1960 permanent)									need studies		
	Management of procurement / integration	CERN to do centralized management.				High-level integration by the ITER organization (IO). Same for the project management. Technical integration is done by unified teams of IO and DAs.				Op-1: ILC Lab. to do centralized management. OP-2: Company to do centralized management. OP-3: Same as Op.1. OP-4: The host to do centralized management.			
	Materials Rights												
	Safety control and approvals												
	Import / Export Taxes												
	Entrance visas for personnel	Member States shall facilitate, for the purposes of the activities of the Organization, the exchange of persons and of relevant scientific and technical information, provided that nothing in this paragraph shall: (a) affect the application to any person of the laws and regulations of Member States relating to entry into, residence in, or departure from, their territories; or (b) require any Member State to communicate, or to permit the communication of, any information in its possession in so far as it considers that											

Legal Issues	Legal status of staff									
	Intellectual properties	The CERNConvention places upon the Organization the obligation to publish or otherwise make available the results of its activities. No publication, communication or use of any piece of knowledge which is acquired from CERN in relation to a CERN contract: and which is patentable or may be considered intellectual property shall therefore be made without prior agreement in writing between the parties. CERN shall not withhold its agreement unreasonably, and shall act withdue diligence in notifying its decision.			Background Intellectual Properties (BIP = IP acquired / produced before ITER agreement or outside) - Members of ITER Org (IO) incorporating BIP grant a non-exclusive, royalty free license to other members of Agreement. Detailed provisions exist for cases with non-confidential and confidential information, and also for commercial fusion use. Generated Intellectual Properties (GIP = IP acquired / produced while executing ITER agrreement) - Member owners of GIP grant a non-exclusive, royalty-free licence					
	Information sharing and publications	CERN shall organize dissemination of information, and the provision of advanced training for research workers, which continue to be reflected in the current programmes for technology transfer and education and training at many levels.								
	Initial investment	any Member State may be required to pay of the total amount of contributions assessed by the Council to meet the annual cost of that programme（In 2001, 940CHF; Germany：21.33%, UK: 16.76%, France: 15.75% , Italy: 12.48%, Spain: 6.94%, Netherlands: 4.62%, Switzerland: 3.50%, Belgium: 2.69%; The Council may establish working capital funds.			3020.7kIUA（1000US$=1IUA) to share by seven parties. EU:45.5%, 9.1% each by Japan, USA, Korea, China, Russia and India					
	Support by the host in relation with the social infrastructure	Taking advantage of Geneve's convenience.			・Land area for site is provided for free. ・Access roads for transporting ITER equipment have been refurbished. ・Educational facilities up to high-schools have been set up for family members of ITER staff.					
	Relation with other organization with attention to maintaining their health	The Convention also states that CERN shall organize and sponsor international co-operation in research, promoting contacts between scientists and interchange with other laboratories and institutes. How about the relation with ICFA?			Relation with international societies of fusion research ?? Need to check.					