ILC ‘Engineering Design’ (ED) Phase

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EDR Project Managers
GDE

ED Activity basis

- Minimal centralized funding
  - **Most funding has strong institutional bias**
    - FP7 and UK are exceptions
  - **ED Progress relies on programs that benefit both ILC and institution**
- Coordination and communication
  - **Take advantage of pre-existing programs**
  - **(must know what these are)**
- A global project requires a transparent, open decision process
  - **in-kind basis**

Goal:

- An ILC Project plan with a cost estimate
  - **Not to exceed RDR**
  - **Completed mid 2010**
- Based on technology developed for TESLA
  - **First Priority – support development of Baseline (RDR '07 → EDR '10)**
  - **But EDR includes and promotes longer term development which addresses**
    - Cost
    - Performance
  - **Development must be *planned* (and reviewed)**

EDR Organization

- Three Project Managers
- 15 Technical Areas
  - **Focus on cost-drivers (SCRF and Civil)**
  - **Inter-area boundaries not fully assigned**
- Group Leadership with technical basis and regional balance
- Boards for oversight (both internal and external - MAC)

ED Activity Management Plan

- "ILC Project Management Plan for the Engineering Design Phase"
  - **by -International Linear Collider Project Management Team: Marc Ross, Nicholas Walker, Akira Yamamoto, Project Managers, *et.al.***
- Includes:
  - **Scope**
  - **Goals, Milestones**
  - **Roles and responsibilities**
  - **Guidelines for Oversight and Decision Making**
  - **Guidelines for relations with Institutional and Regional Management**
  - **Communication Paths**
- Working Document, *release planned for 22.10*

EDR definition

Goal: The primary goal of GDE activities will be to advance

(i) the technology,

(ii) the design and

(iii) the construction plans for ILC, so that

approval for construction can be sought in ~2010.

EDR will

(i) explain the *capabilities of the technology* at that time,

(ii) detail the *design of the machine* and the *construction plans*, and

(iii) present an *updated value estimate*.

Top Priority: Push the Technology AND Control the COST

- fundamental → containment of the current RDR Value estimate.

- potential cost-reduction via good engineering practises
  - **clearly identified in the RDR.**
- Together with the risk-mitigating prioritised R&D program

- the focus of the EDR work.

Industrialization

- Second focus:→ increasing direct involvement of industries
  - **Engineering development / cost saving through industrial partnerships**
- Preparation for mass production
  - **is a critical issue for key technologies,**
  - **understanding how individual countries can contribute in-kind**
- This must be achieved on a truly worldwide basis,
  - **Intend to follow free-market**
  - **including seeking out and developing potential (new) industrial bases**

Our Community – global basis:

- The GDE is committed to these goals
  - **as a global project,** ← ***this is a major ILC strength***
  - **building on the success of the RDR.**
- We must also:
  - **ensure that internal momentum is maintained and**
  - **foster continued growth in the enthusiasm and commitment of the international ILC community.**
- Challenge →
  - **maintain effective communication paths between co-workers separated by great distances.**
- Strength →
  - **diverse technical expertise**
  - **wide ranging laboratory infrastructure**
  - **(result of years of hard work and preparation.)**

Engineering Design Phase Plan

- The basic premise for the ED Phase planning is that the:
  - **Basic ILC design (RDR) is sound.**
  - **Identified R&D is critical for mitigating technical risk and will necessarily remain a focus during the ED phase.**
  - **Cost containment effort is critical, including performance/cost optimization, and an understanding of the performance/cost derivatives (value engineering).**

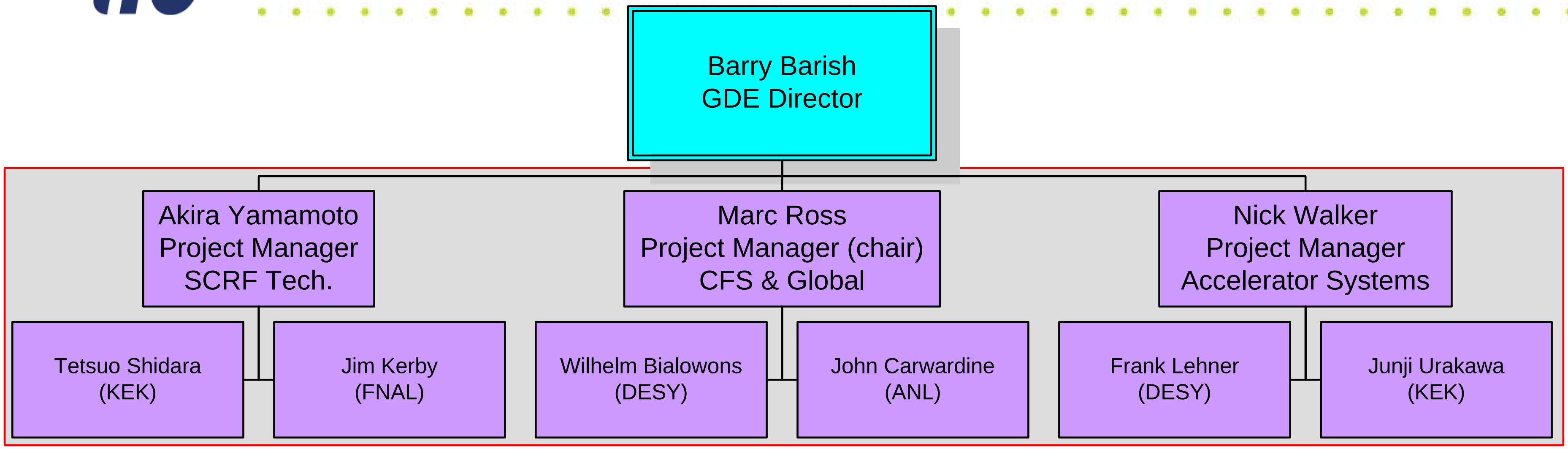
Engineering Design Phase Plan

- RDR identified cost drivers (SCRF technology and CFS) will provide guidance for ED planning.
- Systems (engineering) integration will play a central role.
- Initial phase will be accelerator physics (AP) driven in order to evaluate the performance / risk trade-off for cost reduction.
  - **Engineering resources need to be identified and brought up to speed**
  - **goal is a smooth transition from an AP-driven to Engineering-driven project.**

Access to Resources

- Common Fund Support
  - **Administrative Staff for Director and PM**
  - **Cost & Schedule**
- Regional Support
  - **Technical Management Staffing**
  - **R & D Financial Resources**
  - **The Regional Directors and Institutional Leadership have an important role**
    - Authorize the plan
    - They connect the ILC to technical expertise

EDR ‘Project’ Management



- 3 Project Managers
- 6 Technical Support Staff
  - **One is from the same region as the associated Project Manager and the other is from**
  - **one of the other two regions, but has technical expertise in the same Project Technical Area as the associated Project Manager.**
  - **Most are full time (August 2007)**
  - **Formal launch August 2007**
- Engineering background – top staff from key institutes
- Inter-regional balance

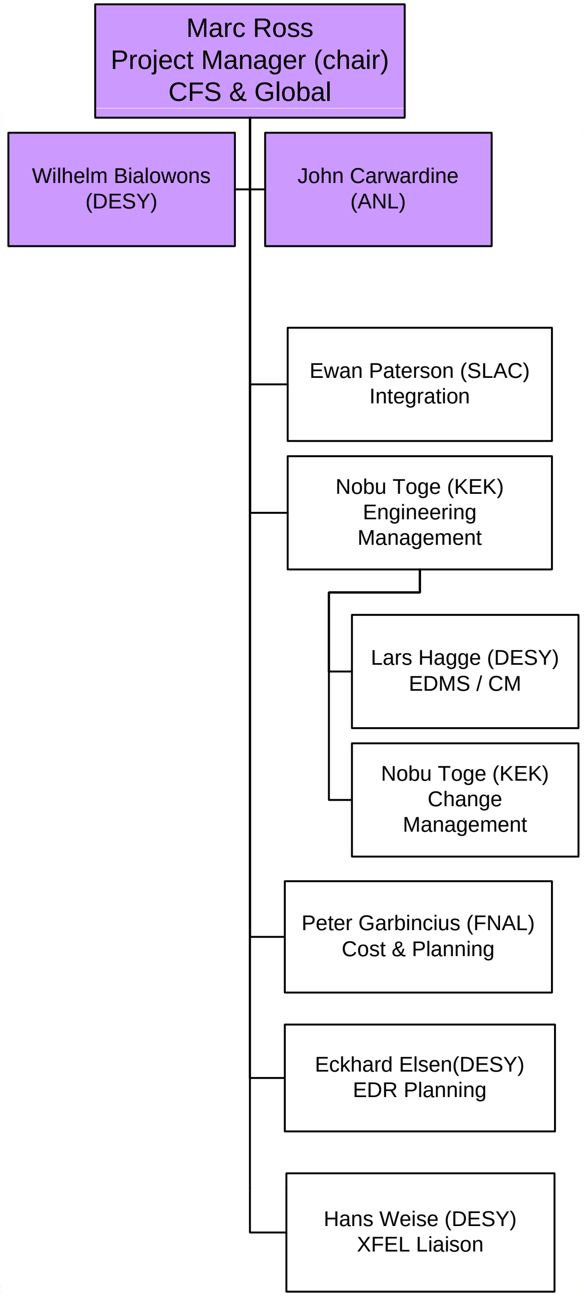
Technical Area Group Leaders

- **Akira Yamamoto**, Project Manager, SCRF Tech.
  - Tetsuo Shidara (KEK)
  - Jim Kerby (FNAL)
  - Lutz Lilje (DESY) – Cavity Processing
  - Hitoshi Hayano (KEK) – Cavity Production & Integration
  - Norihito Ohuchi (KEK) Leader, Harry Carter (FNAL) Co-Leader – Cryomodule
  - Shigeki Fukuda (KEK) – HLRF
  - Tom Peterson (FNAL) – Cryogenics
  - Chris Adolphsen (SLAC) – Main Linac Integration
- **Marc Ross**, Project Manager (chair), CFS & Global
  - Wilhelm Bialowons (DESY)
  - John Carwardine (ANL)
  - John Osborne (CERN) – Civil Engineering
  - Vic Kuchler (FNAL) – Conventional Facilities
  - Margaret Votava (FNAL) – Controls
- **Nick Walker**, Project Manager, Accelerator Systems
  - Frank Lehner (DESY)
  - Junji Urakawa (KEK)
  - Axel Brachmann (SLAC) – Electron Source
  - Jim Clarke (STFC) – Positron Source
  - Andy Wolski (Cockcroft Institute) – Damping Ring
  - Nikolay Solyak (FNAL) – RTML
  - Andre Seryi (SLAC) – BDS
  - Kiyoshi Kubo (KEK) – Simulation

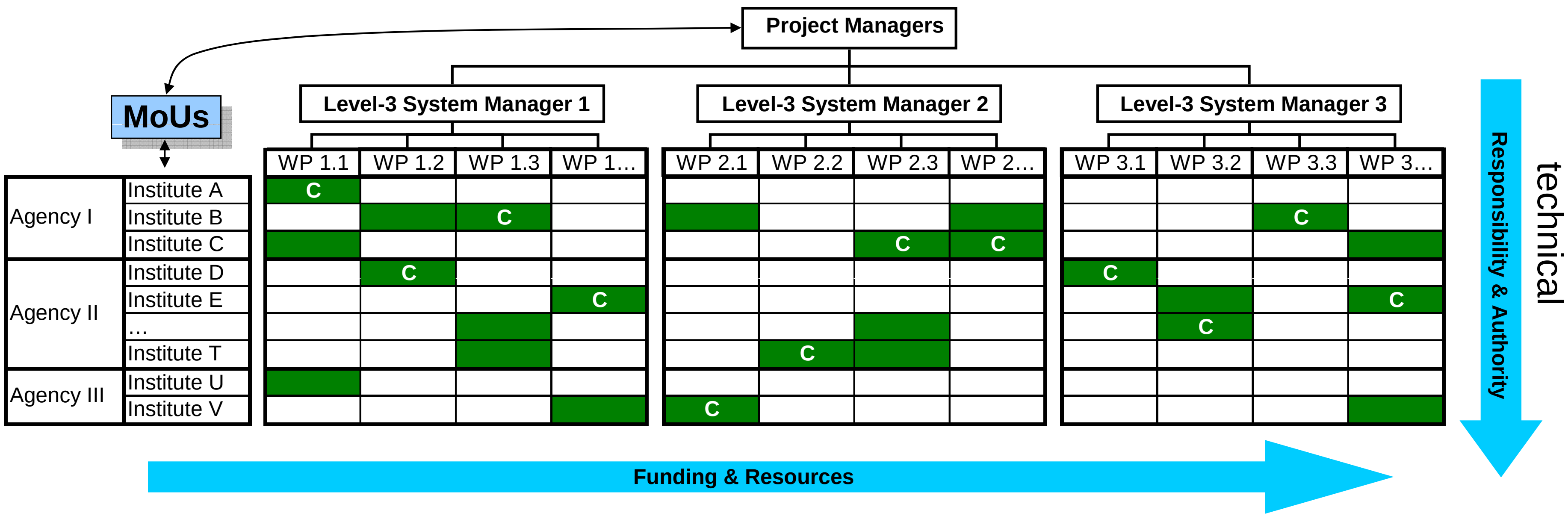
- Engineering and Scientific Management
- 25 (16 below PM)
  - 7 Asia
  - 7 EU
  - 11 Americas

Project Management Office

- Integration
  - **SLAC**
- Engineering Management
  - **KEK**
    - EDMS (DESY)
    - Change Management (KEK)
- Cost/Schedule
  - **Fermilab / Common Fund**
  - **(P. Garbincius – acting)**
- EDR Planning
  - **DESY**
- XFEL Liaison



Managing a non-centrally funded project:



- green indicates a commitment:
  - **institute will deliver**
- MoUs facilitate connection:
  - **Project Management (authority and responsibility) and institutions (funding and resources).**
- The ‘C’ → coordinating role in a WP
  - **Each WP has only one coordinator.**

Example Work Package Coordination →

Area: Main Linac Technology (draft)

Regional/Intsitutional Effort:
- Director-US: Mike Harrison
- Director-EU: B. Foster
- Director-AS: M. Nozaki

Technical Effort (MLT):
- Project Manager: A. Yamamoto
- Associate Managers:: T. Shidara , J. Kerby,

* Group leader, ** Co-leader

Regions	Institutes	Institute Leaders	Cavity (Process) - L. Lilje*	Cavity (Prod./Int.) -H. Hayano*	Cryomodule -N. Ohuchi* -H. Carter(tbc)**	Cryogenics - T. Peterson*	HLRF -S. Fukuda*	ML Integr. - C. Adolphsen*
US	Cornell Fermilab SLAC ANL TJNL	H.Padamsee R. Kephart T. Raubenheimer	H.Padamsee	C.Adolphsen	H.Carter	T.Peterson	R.Larsen	Adolphsen
EU	DESY CERN Saclay Orsay INFN Spain	R.Brinkman J. Delahaye O. Napoly A.Variola C. Pagani			Parma	Tavian		
AS	KEK Korea Inst. IHEP India Inst.	K.Yokoya	Noguchi Saito	Hayano	Tsuchiya/Ohuchi	Hosoyam/Nakai	Fukuda	

Not all slots assigned – *WP/ WP coordinators under consideration*

Work Packages

- Link deliverables to institutions
- Foundation of EDR plan

- How are these devised?
  - Drafted by Technical Area Group Leaders (e.g):

  - Cavity Production / Integration – Hayano
  - Cryomodule Ohuchi/Carter
  - Main Linac Integration Adolphsen
  - Cryogenics Peterson
- Should respect institutional capabilities / interests and regional balance
- Reviewed, Organized and Signed-off by Project Managers

Getting Started – 2007

- Kick-Off Meetings
  - **Organizational, Informational, Planning**
    - Substantial attendance through ‘webex’
  - **Identify key missing RDR items / issues**
    - Typically 10 ‘action items’ – written down
  - **Plan for cost reduction / value engineering**
    - Organizing Cost reduction is a focus
  - **Develop WBS**
  - **13 each**
- GDE Meeting (Fermilab 22.10)
  - **Parallel sessions**
  - **Draft ‘Work Package Matrix’**
- There is no ideal ‘ILC Mailing List’
  - **Communication through Group Leaders**
  - **And at GDE meeting**

Kick Off Meetings

- Global Systems (Controls and CFS – AS, EU, AM)
  - **Completed**
- Main Linac Technology
  - **Cryomodule, Cryogenics (Sept 12-14)**
  - **Cavity (Sept 19-21)**
  - **Main Linac Integration (Sept 27-28)**
  - **HLRF (Oct 1-2)**
- Accelerator Systems
  - **(only RTML so far)**
  - **e+ Oct 8-10 (Daresbury)**
  - **BDS Oct 11-13 (SLAC)**
  - **…**

Example – Controls

- Topic 1: Review the requirements provided by Area Systems with a focus on missing or incomplete items
- 3.1.1 Low Level RF Vector Sum Specification
    - The most important incomplete specification concerns the Low Level RF control of cavity vector sum. Needed information includes the range of bunch and train intensities for which precision control is required, the definition of the beam – based calibration process and the range of allowable maximum cavity gradients within a given RF unit.
- Recommendation for topic 3.1.1
- Since the LLRF system carries substantial technical risk, a carefully determined set of specifications is required. This must be done together with the RTML, Main Linac, BDS and Damping Ring Accelerator Systems Groups.

Example – Controls

- 3.1.3 Specification budget
  - **RDR Area systems specifications are determined based on performance criteria. For a practical engineering approach, subsystem performance requirements must be apportioned out of these. Two such examples are the: 1) BDS inter-crab cavity phase ‘jitter’ and 2) the controls subsystem availability. In these two cases, the performance ‘budget’ allocation part of the value engineering process and will be managed differently – in the former case, several Technical Area Groups are involved (BDS, HLRF, Controls/LLRF, Cryogenics and Cryomodules) so the apportionment must be defined by the Project Management Office. In the latter case, only the Controls Global Technical Area Group is involved, so the process of evaluation (and possible re-allocation) can be done internal to that group, with only sign – off required by the Project Management Office.**

Example - Controls

- Recommendation for topic 3.1.3
  - **The initial phase of the EDR will include a value engineering process which will include an assessment of how to distribute performance ‘budgets’ that indicate sub-system performance requirements. The EDR Project Organization must devise criteria for optimizing system design such that sub-system performance requirements are understood and documented. In the latter example given above, the controls system component availability performance budget distribution can be managed entirely within the Area Technical Group.**

Action items for Cryomodule Group

- Outline Format; preview (no order):
- Cryomodule Procurement
  - **Finding. The main linac technical component procurement plan must account for a general need for each region to receive its share of procurement contracts and, at the same time, provide a competitive environment where the ILC project is guaranteed to achieve the best price / product value.**
  - **Recommendation. The cost engineering team will produce an evaluation of a few (~3) business models for review by the PM team by the time of the Fermilab GDE meeting.**
- QA plan,
  - **Finding. Quality Assurance is the process by which an organization takes responsibility for a product and must include a testing, recording and documentation plan. The associated effort at LHC was underestimated.**
- reliability,
  - **Reliability estimates are required in order to rank ongoing development work. Much work is directed at cryomodule reliability improvement, primarily for tuners. A basic metric is needed to evaluate this work and the need for it**
  - **Recommendation: Devise a project-wide model for evaluation of reliability based on modern FMEA analysis. In the kom there have been three such discussions so far - single tunnel, llrf, cm.**

Action items for Cryomodule

- Specification and interface document preparation
  - **The cryomodule development and fabrication process may involve integration of subassemblies produced in different regions. Because of the complexity of the cryomodule and cryogenics system, performance and interface specifications must be developed. These must include tolerances.**
- Value Engineering
  - **F CM cost containment and reduction are high priority ed activities. VM/VE are ideal processes for cm because many different groups and issues are involved. The process should include cfs, hlrf, llrf, cryo, beam dyn, in addition to the nominal cav/cm groups.**
- Industrial intellectual property
  - **Finding: industry-based design efforts, such as those applied to the design of the STF cryomodule vacuum vessel, will be subject to intellectual property rights concerns. The ILC GDE activities are dependent on a free and reciprocal information flow basis.**
  - **Recommendation: Open access by the ILC ED group should be specified as a part of the contract. Specific proprietary processes may on a case by case basis remain the property of the partner. (Example - klystrons).**

Next Step – 2008

- Work Package summary – Nov 2007
  - **Some flexibility after**
- EDR Plan/Schedule due in early 2008
  - **Start using formal planning tools**
  - **(GDE meeting 03.03)**
- Oversight Process begins – R & D, and Design / Cost effort
  - **Internal / external (MAC)**

LAL / Saclay

- Contribution through work done for XFEL
  - **Development of infrastructure**
  - **and mass production**
    - CM & Coupler
  - **Funded as in-kind contribution to XFEL**
  - **Communicated and monitored through EDR manager**
    - Confidence in XFEL in-kind management process
- To be discussed – Fermilab GDE meeting 22.10