Report of the Director's

Baseline Review Committee

for the

Run IIb Detector Upgrades

Ed Temple, Chair

April 16-18, 2002

EXECUTIVE SUMMARY

Director's Introduction

The Director presented an overview of the Tevatron Collider Program and the proposed Run IIb Detector Upgrades in the context of the overall physics program at Fermilab. He clearly stated that the Collider Run II is the most important activity at Fermilab. Run II is composed of two parts Run IIa and Run IIb. The Run IIa detectors, presently operational, will collect between 2 and 4 inverse femtobarns before the silicon detectors are so severely damaged by the accumulated radiation doses that they no longer work. Thus Fermilab is planning the Run IIb upgrades to allow running to an integrated luminosity of ~15 inverse femtobarns. The present long range plan provides for the installation of the upgrades in calendar year 2005.

A key part of the charge to committee for this Director's Review was to determine if the Upgrade Collaborations are ready for a DOE Baseline Review and if not provide suggestions to help them become ready.

Scope

An upgrade is planned for both the Collider Detector Facility (CDF) and the DZero (D0) detectors. The primary scope of these upgrades is the replacement of the silicon detectors. Other system upgrades are considered as well including data acquisition and triggers to deal with the higher luminosities expected in Run IIb. The Silicon upgrades are well defined, but the others are not as well developed. In addition, CDF described additional possible scope upgrades that are under consideration.

The scope for all systems will need to be well defined prior to a DOE baseline review. Specific suggestions and recommendations for improving the readiness for a baseline review are contained in this report.

Cost

Cost estimates for M&S (materials and supplies) and Labor were shown for each upgrade. It is not clear to the committee that all required labor has yet been identified (this comment applies to both detectors, but more so to CDF). A detailed "basis of estimate" (including quotes, engineering calculation, drawings, and cost studies) was not shown by either project. Such will be needed at a DOE Baseline Review.

Given the problems experienced during the Run IIa Silicon Detector construction and commissioning, and the committee's feeling that the proposed schedule is quite optimistic, we recommend increasing the contingency to 60% on the silicon for each project. Other contingency increases are suggested as well. The only change in the base estimate suggested by the committee was for the D0 sensors where a recent quote has been obtained that reduces the cost.

Schedule

These upgrades, unlike many "scientific" projects do not have an open ended completion date. They must be completed in time to 1) replace the present Silicon Detectors before they are "burned out" due to radiation damage and 2) in time to collect significant data before the Large Hadron Collider comes fully on line, presently thought to be in 2007-8.

The critical path schedule for both upgrade projects is the silicon subdetector. Both projects currently show a Silicon "ready to install" date of May 31, 2005. It is the sense of the committee that this is an optimistic date. However, we do encourage to collaborations to manage aggressively to an optimistic schedule. But, to provide for possible delays we suggest a significant float be added to project completion, perhaps as much as a year beyond the Silicon ready to install date.

Management

The committee feels that both project teams must be strengthened significantly to successfully complete these upgrades within the given window frame. This includes additional people, both managers and staff. The managers need to become steeped in a project culture that focuses adequately on schedule so that projected completion milestones are met. The application of project management tools such as statusing schedules, calculating earned value, implementing change control systems, and expediting critical tasks will help in meeting schedules and containing costs, but will require additional people with special skills.

The charge asked the committee to review the special documentation required by DOE such as an Acquisition Execution Plan (AEP) and Project Execution Plan (PEP). Only a draft PEP for D0 was available, but comments for improvement are provided in this report. Similarly comments for improving the Memoranda of Understanding signed with University Collaborators are provided.

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1. Section Common to Both Detectors

1.1. Introduction

1.2. Scope of the Proposed Upgrades

1.2.1. Findings

- The D0 and CDF collaborations have produced informative and impressive TDR's on their upgrades, and made excellent presentations during the review.
- The scope of the silicon upgrades is well defined and understood.
- The scope of some of the smaller upgrades is not well defined.
- The radiation protection systems for the silicon detectors were not discussed.
- The silicon sensor testing plans are different for the two experiments.

1.2.2. Comments

- We commend and thank the D0 and CDF collaborations for their hard work in defining and presenting their plans for Run 2b.
- Reduction of the long period of time needed to achieve silicon functionality after installation in Run 2a is insufficiently addressed in the plans for Run 2b. For CDF, it appears that insufficient systems testing was performed for Run 2a, and for D0 it appears that schedule slip resulted in the completion of tasks during inconvenient Run 2a access periods.
- The D0 silicon scope is slightly larger than that of CDF, because a smaller sensor pitch was chosen by D0. The smaller pitch is desired due to a difference in capability between the outer tracking systems.
- The D0 low-mass jumper cables are outside the stave assembly. The CDF silicon bus cables are inside into the stave assembly, presenting significant risk for noise issues, while allowing a clean assembly package.

- The sensor, SVX4, and the hybrid programs appear well planned, and the plans have profited from prior experience.
- The silicon stave concept is new, and presents risks for a variety of unforeseeable problems.
- The stave cooling is generally more challenging than used in previous detectors, and presents a variety of risks.

1.2.3. Recommendations

- Develop plans to insure that the Run 2b silicon detectors are more fully functional at the time of installation then were the Run 2a silicon detectors.
- Understand differences in silicon sensor testing plans between CDF and D0: one of the experiment is under(over)estimating the amount of work that is needed.
- Explore more common effort in stave cooling design and prototyping.

1.3 Total Project Cost Estimates

1.3.1 Findings

- The Committee was favorably impressed by the preparation of both CDF and D0 for this review.

- The TDR give a good technical description of the Run IIb Project(s). The largest L2 subsystem is well defined and well specified technically.

- The next task is, by creating a very detailed and unique (no options) plan, to convert that description to a coherent (uniform) and reviewable resource loaded schedule.
- The quality of a cost estimate derives from the completeness of the set of schedule tasks and of the set of resources assigned to those tasks.

- How has the Project done so far in meeting the schedule? the estimated costs? (contingency use?)

- The WBS Dictionary was presented to the Committee as part of the “notes field”. It should have enough detail to stand alone (between schedule and BOE) as a brief description of the Project.

- A sufficiently documented BOE was not shown to the Committee. Therefore, the Committee could not “drill down” to assess the validity of the cost estimates. The quality of the BOE which is prepared will be important to the success of future reviews of these Projects. The documentation should include vendor quotes, engineering designs, engineering cost estimates, and time and motion labor studies.

- The CDF base cost was presented to be 14.80 AYM$ with a 44% contingency for a TPC of 21.9 AYM$. The D0 base cost was 19.8 AYM$ with a 41% contingency for a 27.95 AYM$ TPC. The differences in these estimates need to be better understood.

1.3.2 Comments

The Projects might be well advised to:

- Use the FY instead of the CY – since BA arrives with the FY.
- Be very explicit in the WBS cost rollup = FY02$. Then add contingency in that metric and then escalate to AY$. This should avoid confusion on the part of the reviewers.
- Show the Resource Sheets – with all indirect costs (~ 2x of straight salary at FNAL) included up front as the “cost of doing business”.
- Adopt an agreed upon template for both Projects of resource costs for FNAL techs and engineers and a generic “university” also.
- Only show AY$ at L2 and above. Invoices and BA are in AY$ and you want to use a consistent metric.
- Adopt a consistent and Project wide contingency methodology and evaluate all task (labor and M&S) contingencies at the lowest level appearing in the WBS. Do not put in “hidden” contingency. There is now a labor contingency of 50% explicitly, with another factor

which is hidden. This is not transparent. A better procedure is to reduce the task duration keeping resources fixed. In that way explicit slack time is generated which can be tracked.

- Report only on a total project contingency. That is to avoid the perception that there is a distinct/explicit, say, L2 contingency.
- Escalate the base cost + contingency instead of adding contingency in AY$ at the end. The contingency is estimated as applied to FY02$ tasks.
- The total costs in AY$ as a function of FY at L2 is a useful plot. The total “resources” = Techs + Engineers + Physicists (FTE) as a function of FY is also a useful plot.

1.3.3 Recommendations

- Show only the TPC, not separate M&S and Labor.
- Review the schedule and make sure that all tasks, e.g. non – U.S. are explicitly part of the schedule.
- Load the schedule with **ALL** the resources needed to bring the Project to a successful conclusion – graduate students, postdocs, professors, foreign contributions, etc.
- Explicitly label a task as R&D or Project, including all tasks in the schedule.
- Agree on base labor costs and indirects between CDF and D0.
- Supply a Resource sheet containing all labor indirects as the “cost of doing business”.
- Same for M&S – indirects in the BOE.
- Assess contingency for those uncosted resources (base program) which have significant risk at the lowest task level.
- Present a detailed Basis of Estimate with vendor quotes, engineering estimates, etc. This document should not be electronic
- The BOE should be mapped with the WBS structure so that reviewers can “drill down” transparently.
- Apply contingency at the lowest level WBS task for both labor and M&S.
- Add tasks describing the operation of a “Project Office” sufficient to allow for proper management of the Project, e.g. tracking, reporting, SOW, MOU, procurement, etc.

- The schedules have many tasks that are dependent on timely issue of P.O.s. Need to have a buyer identified from purchasing and assigned as a member of each project team. One buyer for both could be acceptable.
- Procurement needs to be shown on the project organization chart.
- Make sure the MOU and SOW and Monthly Reports and other documents are derived from the Project file so that it is the unique source to define the Project and all other items are derived from it.
- The Committee has examined the cost estimates and has arrived at the following table.

		Project Estimate				Committee Estimate			
	Items	Base	Cont. %	Cont. $	Total	Base	Cont. %	Cont. $	Total
D0	Silicon Tracker	$15,539,082	42.5%	6,603,769	$22,142,852	$15,089,082	60%	$9,053,449	**$24,142,532**
	Level 1 Calorimeter	$1,753,596	28.4%	498,340	$2,251,936	$1,753,596	30%	$526,079	**$2,279,675**
	Level 1 Cal/Track Match	$264,116	32.0%	84,559	$348,676	$264,116	40%	$105,646	**$369,762**
	Level 1 Track Trigger	$980,125	45.2%	442,967	$1,423,093	$980,125	70%	$686,088	**$1,666,213**
	Level 2b	$108,305	45.5%	49,307	$157,612	$108,305	50%	$54,153	**$162,458**
	Level 2 STT	$514,786	42.2%	217,078	$731,864	$514,786	50%	$257,393	**$772,179**
	Online	$656,686	36.1%	237,032	$893,718	$656,686	50%	$328,343	**$985,029**
	Project Office					$500,000	50%	$250,000	**$750,000**
	Total	$19,816,697	41.0%	8,133,052	$27,949,749	$19,866,697	57%	$11,261,151	**$31,127,848**
CDF	Silicon Detector	$12,472,938	44%	$5,454,147	$17,927,085	$12,472,938	60%	$7,483,763	**$19,956,700**
	Central Preshower	$805,503	34%	$272,835	$1,078,338	$805,503	35%	$281,926	**$1,087,429**
	Event Builder	$509,815	56%	$286,947	$796,762	$509,815	35%	$178,435	**$688,251**
	Electromagnetic Calorimeter Timing	$208,051	0%	$0	$208,051	$208,051	50%	$104,026	**$312,077**
	Installation	$683,889	30%	$205,167	$889,055	$683,889	50%	$341,944	**$1,025,833**
	Administration	$517,424	45%	$232,664	$750,088	$517,424	50%	$258,712	**$776,137**
	Total	$15,197,620	42%	6,451,760	$21,649,380	$15,197,620	57%	$8,648,806	**$23,846,426**

- 60% of the base estimate. This level of contingency is in line with past Run IIa experience and the planning of US LHC experiments.
- The base cost of D0 Si was reduced to account for recent vendor quotes.
- The L1 track trigger for D0 was thought to be not fully defined, and therefore a 70% contingency was assigned. Subsystems which were not presented were assigned a 50% contingency. They should be internally reviewed prior to the Lehman review.
- The CDF event builder appeared to be largely a commercially supplied device. Therefore a 35% contingency was assigned to this subsystem.

1.4 Schedule

1.4.1 Findings

- Both D-0 and CDF groups presented resource-loaded schedules for their respective Run IIb efforts that are consistent with having the Silicon Detectors ready for installation by 31May05. Each installation phase ends with a 'Commissioning Complete' milestone on 13Oct05.

- Both D-0 and CDF groups presented critical paths for their silicon detector efforts (the dominant sub-project). No integrated master schedule was presented or available.

- Milestones for both projects were presented, however milestones for Fermi Management and DOE were not clearly presented/defined.

- Manpower levels at SiDet to support the efforts of CDF and D-0 will be at a historic maximum, p….. during FY03-FY04 period.

- Both D-0 and CDF groups, in an effort to understand the effects of labor inefficiencies, have added time contingency at the task level. These values are then compounded with an additional money contingency at Level 1.

- Both D-0 and CDF groups presented critical paths for their silicon upgrade efforts.
    - Each critical path showed little slack in the ready for installation milestone of 31May05.
    - Schedule risks are mostly present in the Silicon detector subsystems.

- The SVX4 chip design is mature and well-supported. It is possible, though certainly not guaranteed, that the submission submitted in the Fall 2002 will be the final design. Probability of an extra submission is 0.5.

1.4.2 Comments

- The committee was impressed at the level of detail and effort that both groups has put into the review materials. It is clear that a great deal of work has gone into this effort and the committee thanks them for presenting detailed project plans.

- The committee felt that the current schedules presented were unrealistic for the defined scope of each project. At the current time, the committee felt there was a risk of up to a year slip in the detector available date.

- There are areas of schedule risk that should be noted and alternative strategies developed. These are;
  - SVX4 chip, hybrids, and stave development. Be sure to include adequate time for testing and integration.
  - Coordination of parts flow and assembly at SiDet. This must be carefully monitored to reduce cost and schedule inefficiencies and optimize the efforts on each project, particularly during the peak loading at SiDet (FY03-FY04).
  - Assembly, installation, and pre-beam commissioning of each silicon detector must be sufficiently staffed with post-docs to ensure that the system integration efforts occur before installation.

- An integrated master schedule is needed to fully understand the critical path for the whole project and the overall resources necessary to meet the completion milestones. This integrated master schedule will also help to see what is just off the critical path for the entire project as well as each L2 subsystem.

- The committee is concerned about the current status against the schedule as both projects have not requested resources at the levels called for in the project files. This implies that the schedule is currently slipping from the current projection.

- Look for opportunities to advance the engineering design and production efforts whenever possible to improve slack against the baseline schedule.

- The committee is concerned that the pre-beam commissioning time needed for Run IIb is lower by ~3 months from that experienced in Run IIa. System integration must not be sacrificed for installation first with testing and integration later.

- Procurement of key components must be placed with sufficient time to ensure that all parts are available for the SiDet production teams. This effort should be coordinated between both groups to

- The committee urges both groups to consider the use of common components and procurement along with design strategies for each project whenever feasible. This will allow economies of scale to be employed resulting in a simpler assembly process and less schedule risk.

1.4.3 Recommendations

- For both the CDF and D-0 schedules, review the project at the lowest WBS level remove slack and show baseline efforts only. This baseline effort should be what you really want to measure your progress against. Schedule contingency (slack) should be called out explicitly either by a gap in tasks versus fixed milestones or as an explicit slack task.

- The committee urges both D-0 and CDF to consider project scope based upon physics AND schedule. A well-built detector installed and commissioned late may be of little value in the LHC era.

- Present one-page critical path (summary sheet) schedules for each subsystem and also for each project. All tasks should be measured using base efforts with no 'hidden' float. Schedule contingency should be shown explicitly as float.

- The committee urges both D-0 and CDF to begin monthly statusing of their projects using earned value measurements as a way to coordinate its efforts as well as determine its current progress. Milestones should be tracked and reported against with variances (baseline vs actual) noted.

- Present time-phased resource plots for all FTE's (post-docs, engineers, technicians, etc.) for each subsystem as well as for each total project. Common metrics and formats should be used across projects. Use fiscal year divisions to agree with funding support.
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1.5 Management Considerations

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The committee thanks the D0 and CDF project managers for their candid presentations and discussions. The committee was impressed with a substantial amount of effort and progress made on establishing the cost and schedule of both projects. We concluded that the both project teams will be capable of providing the leadership and technical expertise needed to complete the project.

However, the committee felt that there are some holes in the project management organization and a fair amount of refinement on cost and schedule yet to be worked out before these projects can be ready for the baseline review.

1.5.1 Findings

- Acquisition Execution Plan : A draft of the Acquisition Execution Plan covering the common procurement issues for CDF and D0 Run IIb upgrade projects was available for this review.

- Contingency Analysis : The following guidelines were presented by the D0 and CDF project managers, where the methodologies for the M&S appear to be quite different between the two projects.

M&S for D0

No detailed conceptual design	70%
Detailed conceptual design but scope might change	50%
Quote with detailed design	30%
Ordered but not delivered	15%
Completed	0%

SWF for D0 : 50% applied at high level role-up

M&S for CDF

Physicist's estimate	50%
Engineer estimate	30%
Vendor info	20%
Vendor quote	10%

SWF for CDF : 50% applied to most of tasks (except 30% on installation tasks)

Furthermore, the contingency analysis descriptions by the lower level managers were often inconsistent with these guidance.
Although the guidance's from each project sound quite different, the overall contingency figures for each project were pretty close.
D0 41% CDF 44%

- Schedule Float : Summary schedule for the critical path activities was presented upon the request by the committee. Schedule showed no float and appeared to be extremely tight.

- Common project : Two projects share commonality for the construction of the silicon detectors, both technical and managerial point of view. There is a significant amount of collaborating effort between two projects in the areas of SiDet management and SVX4 chip development and sharing of technical information and resource planning.

- Project management tools : Management tools are starting to be implemented but managers are yet to be trained on using these tools, such as resource loaded schedule, statusing and cost and schedule variance analysis. The committee has not been convinced that the current teams are properly configured to maintain progress against the baseline schedule. As evidence, we note that neither upgrade effort is spending $ or using resources (even asking for resources) at levels estimated in the project files for the current period. The need to spend money and employ resources will only increase, as the aggressive schedule for these upgrades continues to unfold. Please get going!

1.5.2 Comments

- Acquisition Execution Plan : Draft appears to be in a good shape.

- Contingency Analysis : The overall guidance either should be followed with a very few exceptions or should be eliminated if a large fraction of tasks being treated as exceptions.

- Schedule Float : A couple of tasks were identified as possibly having a "built-in & hidden" schedule float.

- Common Project : Given the technical difficulties and extremely tight schedule for both Silicon projects, and their importance to the Run2b physics program, the collaborating effort should continue to be encouraged and pursued, especially in the areas of resource planning.

- Project management tools : For the CDF and D0 upgrades to be successful, the schedule must be carefully monitored by management with the ability to respond to problems quickly while they are small and do not erode the master schedule.

1.5.3 Recommendations

- Acquisition Execution Plan : Finalize the draft before the DoE baseline review.

- Contingency Analysis : Describe the overall guidance in a consistent way with the methodology used by the subprojects.

- Schedule Float : Remove the "built-in & hidden" schedule floats but rather show them explicitly, perhaps similar way as showing overall contingency for the project cost.

- Common Project : Projects together with the PPD management and directorate should give a careful evaluation of the laboratory resource availability for silicon detector construction.

- Project management tools : The committee strongly urges that the CDF and D0 groups begin to status their resource-loaded schedules and use the measured progress and management tools to understand where future problems and risks might arise.

- The Fermilab directorate should manage these upgrades in an active, aggressive manner. This would include monthly reports with presentations showing milestone status, resources expended and progress achieved.

2. DZero Specific Items

2.1 Introduction

2.2 Scope of the Proposed Upgrade

2.2.1 Findings

- The scope of the Silicon project is well defined.
- The plans for design through testing and installation for the silicon detector are generally adequate.
- Aspects of the scope of the D0 installation integration were not understood by committee.

- The D0 L1 Calorimeter Trigger project shows understanding of their scope, but the project scope is insufficiently defined.
- The D0 L1 Track Trigger project has incomplete understanding of their scope.
- The committee did not assess the scope of the L1 Track Match trigger, the L2 upgrades, nor the Online upgrade.

2.2.2 Comments

- The successful operation of a full prototype stave does not appear prominently in the testing plans.
- The D0 cooling and mechanical modeling efforts are well advanced.
- The D0 L1 Track Trigger may adjust their scope after the incorporation of noise into the simulation of efficiencies and fake rates.

2.2.3 Recommendations

- Add an explicit milestone for a full prototype stave system test.
- Develop a feasible baseline for D0 L1 Calorimeter Trigger project.
- Complete D0 L1 Track Trigger simulations, then develop a feasible baseline.
- In the baselines for the D0 L1 Calorimeter and Track Trigger projects, include all resources, including both labor and M&S regardless of funding source.

2.3 Total Project Cost Estimates

2.3.1 Findings

- D0 plans to upgrade its L1 calorimeter trigger to improve its performance with 132 ns bunch spacing and high luminosity. Digital signal processing would be done using a series of digital samples of the calorimeter pulses. This would yield an improved estimate of the energy in the bunch crossing of interest even in the presence of closer bunch spacing and higher occupancy. The use of the energy measurements would also be improved to better estimate the energy and direction of jets, electrons and photons.

2.3.2 Comments

- The proposed calorimeter trigger upgrade appears to be well justified and technically sound. However, there are still many details to be settled. Quantitative specifications have not yet been established for many elements of the design and this makes cost estimates uncertain and delays progress on detailed design.

2.3.3 Recommendations

- Establish draft baseline specifications for the calorimeter upgrade as soon as practical. Incoming and outgoing signals should be specified for all PCBs in the system. This will be a point of reference for further design studies.

- Add specific additional contingency to cover the MRI for the L1 trigger as there is additional risk for pending NSF proposals.
- Provide a glossary for the Schedule and Dictionary – FLA, TLA
- Add R&D tasks and their costs/resources and explicitly label the task as R&D.
- Have the PM appear as a full time job - no parens.
- Remove the M&S spreadsheet. Add Contingency % in the WBS dictionary. Give one dictionary for Labor and M&S in toto.
- D0's dictionary uses the names on their M&S Excel Spreadsheet and not the names listed in the schedule for each WBS number. The BOE WBS names need to match the schedule names to eliminate any confusion.

2.4 Schedule

2.4.1 Findings

Add in zero contingency on SVX4 …

- The D-0 group has added a 5 month explicit contingency with respect to the ‘Detector Ready for Installation’ date of 31May05.

- The D-0 group has used a 70% efficiency factor to estimate its manpower needs.

- Labor contingency was added at L1 applying 50% (FY03), 75% (FY04), and 75% (FY05) respectively.

2.4.2 Comments

- The D-0 group did not call out its installation tasks as a separate section. This makes it difficult to see the system integration efforts across subsystems.
- The D-0 group mentioned generating separate L2 installation schedules and identifying a specific individual for the work. This should be done so that the installation can be coordinated for all installation efforts. This coordination should also include space and equipment.
- The D-0 project schedule has not been updated for the work that is currently in progress. Since the D-0 group has stated that they are using ~6FTE’s when ~10FTE’s are scheduled, there is a concern that the current schedule completion date is slipping later than what currently presented.
- While the labor contingency applied at L1 is essential to manage the project, it may not help to solve the schedule in the later stages, when specialists are necessary to commission the detector.

2.4.3 Recommendations

- Consider calling out a separate WBS section for integration and installation tasks.

- Include post-doc FTE estimates in all manpower plots to ensure that the necessary resources are available when needed.

2.5 Management Considerations

2.5.1 Findings

- Management Structure : The organization is in place, however appears to have the following weaknesses.
  - Based on the organization chart shown in draft PEP, it was not clear to the committee that how this detector construction project will work as a line management structure, especially related to the Fermilab management (directorate and PPD).
  - The Project Manager shows on org chart as ( )
  - Project office has not quite established with adequate staffing.
  - No dedicated person assigned to coordinate installation activities.

- Project Documentation : The committee was provided with a draft Project Execution Plan (PEP). The committee found that this draft PEP to be unnecessarily detailed (such as work plan for subproject tasks, low level resource profile tables) with some key information missing such as a definition of the "Project Complete". The committee was also provided with the signed version of Memorandum Of Understanding (MOU) between KSU and Fermilab. We felt that this MOU has unnecessarily sections and its structure and content might not be adequate to manage the project with >4 year duration.

- Risk Analysis : Silicon project and trigger upgrade project presented analysis of schedule risk titled as "sensitivity analysis" or "schedule contingency". The committee noted that the project took a good initiative for conducting these risk analysis.

2.5.2 Comments

- Management Structure : This magnitude of project will require a sizable team of project management office in order to keep up with the tracking and reporting of the aggressive schedule.

- Project Documentation : There are existing PEP & PMP and multi-year MOU & annual SOW document templates from CMS Project and NuMI/MINOS Project. D0 management should take a look at these existing and working document and see what can be adopted in order to simplify and make more functional.

- Risk Analysis : There are a few other areas with technical, cost or schedule uncertainties which might benefit by conducting a similar risk analysis.

2.5.3 Recommendations

- Management Structure : The organization should to be strengthened in the following areas
  - The project and the collaboration should work with the laboratory management in order to clearly define the project management structure, especially related to Fermilab management.
  - The Project Manager should be a full time position without any other responsibilities.
  - Project office needs to be established with an adequate staffing as soon as possible.
  - A dedicated person should be named to coordinate overall installation activities.

- Project Documentation : Take a look at examples of PEP (PMP) and MOU, SOW from existing construction projects at Fermilab and try to simplify these documents. The content should be clear, brief, and get to the point on exactly what you are going to do. The project should produce the final draft of PEP by May 15.

- Risk Analysis : Conduct project wide risk analysis for the areas which have technical, cost or schedule uncertainties.

3. CDF Specific Items

3.1. Introduction

3.2. Scope of the Proposed Upgrades

3.2.1. Findings

- The scope of the Silicon project is well defined.
- The plans for design through testing and installation for the silicon detector are generally adequate.
- The CDF Installation and Event Builder projects have well-defined and understood scopes.
- The CDF Preshower and CDF EM Timing projects show understanding of their scope, but the project scope is insufficiently defined.

3.2.2. Comments

- The successful operation of full stave prototypes appears prominently in the testing plans, and we believe this effort is critical to the success of this silicon project.
- The CDF Event Builder, CDF Preshower, and CDF EM Timing projects display an absence of integration into the CDF project management system.
- Scope increases for the COT, L2 Trigger, and TDCs were mentioned.

3.2.3. Recommendations

- Develop feasible baselines for the CDF Event Builder, CDF

Preshower, and CDF EM Timing projects, with the inclusion of all resources, including both labor and M&S regardless of funding source.
- Integrate the CDF Event Builder, CDF Preshower, and CDF EM Timing projects into the CDF project management system.
- Either eliminate or fully develop scope increases by the time of the Lehman review.

3.3. Total Project Cost Estimates

3.3.1. Findings

- The CDF trigger for electromagnetic calorimeter timing presented no contingency. Based on the maturity of the design, a 50% contingency was assigned to the project.

3.3.2. Comments

- Add contingency column to the lowest level WBS printout so that reviewers can see contingency at the lowest level.

3.3.3. Recommendations

- Remove the SiDet explicit contingency of 250 k$. Put it in the overall contingency if appropriate.
- The CDF Installation schedule has no M&S costs. It was stated that operating would pay for any materials. If the materials are need to complete the project the cost should be included in the project.
- Check the rollup from the lowest WBS costs to the top level for consistency. This should not be done by hand, but with a dedicated macro.
- Re -evaluate the installation tasks and costs, since this effort is short w.r.t. D0 yet it entails a rollout (3 months alone).

3.4. Schedule

3.4.1. Findings

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    - The CDF schedule shows a 0-month slack period with respect to the ready for installation date (31May05).
    - Relies on two engineering runs (ER1, ER2) and a final production run to produce the needed SVX4 parts. If the ER1 produces acceptable parts, then ER2 run can be removed which would provide nearly 7mo of schedule float.

3.4.2. Comments

- CDF presented a ~6month installation schedule which may be tight considering ~6 weeks are required for the detector roll-out and 6 more to roll-in. D-0 estimates ~7.5 months with no rollout.

3.4.3. Recommendations

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3.5. Management Considerations

3.5.1. Findings

- Management Structure : The organization is in place, however appears to have the following weaknesses.
    - Based on the organization chart shown, it was not clear to the committee that how this detector construction project will be interacted with the PPD management.
    - Project office has not quite established with adequate staffing.

- Project Documentation : **The committee was not provided with any PEP or overall project management document.** The committee was provided with a draft (?)MOU between LBNL and Fermilab. We felt that this MOU has missing some of key elements and its structure and content which might not be adequate to manage the project with >4 year duration.

- Risk Analysis : **There was almost no risk analysis presented** with exception of installation activities.

- Cost table presented by a couple of subprojects in CDF included the estimated bottom up contingency analysis figures as a part of total cost for the subproject.

3.5.2. Comments

- Management Structure : This magnitude of project will require a sizable team of project management office in order to keep up with the tracking and reporting of the aggressive schedule.

- Project Documentation : There are existing PEP & PMP and multi-year MOU & annual SOW document templates from CMS Project and NuMI/MINOS Project. CDF management should take a look at these existing and working document and see what can be adopted in order to simplify and make more functional.

- Risk Analysis : There are a number of areas with technical, cost or schedule uncertainties which might benefit by conducting a risk analysis.

- Cost tables in the subproject talks should not include the contingency under "total cost". Contingency belongs to the Project Manager, not to the each subsystem.

3.5.3. Recommendations

- Management Structure : The organization should to be strengthened in the following areas
  - The project and the collaboration should work with the laboratory management in order to clearly define the project management structure, especially related to Fermilab management.

- Project office needs to be established with an adequate staffing as soon as possible.

- Project Documentation : **Final draft of PEP and a reasonable shape MOU example or template should be produced by May 15.** Take a look at examples of PEP (PMP) and MOU, SOW from existing construction projects at Fermilab and try to simplify these documents. The content should be clear, brief, and get to the point on exactly what you are going to do.

- Risk Analysis : Conduct project wide risk analysis for the areas which have technical, cost or schedule uncertainties.

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Action Items

1. CDF and DZero Run IIb Projects will reach agreement with Fermilab and DOE on the scope and schedule for the first DOE Critical Decision Review.

    - May 7, 2002

2. CDF and DZero Run IIb Projects and Fermilab will agree on a well defined scope for the Projects.

    - June 21, 2002

3. Fermilab and the projects will agree on a date for next Director's Review

    - June 21, 2002

4. Projects will respond to each of the recommendations and comments of this Review.

    - May 15, 2002

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Michael Witherell

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Jonathan Kotcher, DZero

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Pat Lukens, CDF

APPENDICES

A. Charge to the Review Committee

Charge for the Director's Baseline Review Committee for the Run IIb Detector Upgrades
April 16-18, 2002

The CDF and D0 collaborations are preparing to start upgrade projects that will make it possible for the experiments to continue operating at higher and higher luminosities through 2008. The systems needing the most attention for higher-luminosity running are the silicon detectors and the data-acquisition/trigger system. The collaborations have submitted Technical Design Reports (TDRs) for these and other required/desired upgrades. The current schedule calls for installation of the new silicon and possibly other detector components in calendar 2005. For the success of the Tevatron Run II program program, it is imperative that both the D0 and CDF upgrades be accomplished on this time scale.

This Director's Baseline Review Committee (BRC) has the primary goal of determining the readiness of the upgrade projects to successfully complete a DOE Baseline Review. In this regard, the BRC should:

- Examine the scope of the proposed upgrades. Determine whether the scope is well defined and understood by key participants. Assess the plans for carrying out the design, prototyping, fabrication, assembly, installation and testing of the proposed upgrades.
- Assess the Total Project Cost estimate for the upgrades. Review and assess the detailed "basis of estimate" for the upgrades (both for the R&D components and the "on-project" components). Understand the risks involved in carrying out the projects and assess the cost contingencies that are being proposed.
- Assess the realism of the schedule. Is there a detailed schedule, including a critical path, for completing the project? Are milestones appropriate in number and type identified so that both the project teams and Fermilab management can effectively track and manage progress? Based on past experience, can the proposed schedules be met? Are appropriate schedule contingencies provided? Is there a "resource loaded schedule" and identified needed resources (M&S, technical support staff, and physicists)?
- Comment on the proposed management arrangements for the upgrades. Assess the proposed management arrangements. Review and assess the formal required DOE documentation: Acquisition Plan, Project Execution Plan, and plans for providing the required reports.

Review findings, assessments, and recommendations should be presented in writing at a closeout with the Collaborations and Fermilab management.

B. Committee Membership

Name	Affiliation(s)
Aesook Byon-Wagner	Fermilab/NuMI
Claudio Campagnari	UC/Santa Barbara
Dan Green	Fermilab/CMS
Dean Hoffer	Fermilab/Directorate
Harry Nelson	UC/Santa Barbara
Jim Pilcher	Univ. of Chicago
Mark Reichanadter	Fermilab/CMS
Ed Temple (Chair)	Fermilab/Directorate
Bob Tschirhart	Fermilab/PPD

C. List of Attendees

CDF
Nicola Bacchetta
Franco Bedeschi
Doug Benjamin
Brenna Flaugher
Al Goshaw
Joey Houston
Nigel Lockyer
Pat Lukens
Cathy Newman Holmes
Christoph Paus
Rob Roser
Dale Knapp
David Toback

DZero
Alice Bean
Bill Cooper
Marcel Demarteau
Hal Evans
Bill Freeman
Marvin Johnson
Jonathan Kotcher
Meenakshi Narain
Andrei Nomerotski
Rich Partridge
Harry Weerts
John Womersley
Darien Wood
Colleen Yoshikawa

Reviewers
Aesook Byon-Wagner
Claudio Campagnari
Dan Green
Dean Hoffer
Harry Nelson
Jim Plicher
Mark Reichanadter
Ed Temple (Chair)
Bob Tschirhart

Observers

Directorate

DOE

Jim Miller
Jane Monhart
Paul Philp

D. Review Agenda

April 15, 2002-ms

Agenda for Run IIb Detector Upgrades Director's Baseline Review
April 16 – 18, 2002
Comitium

Tuesday, April 16

8:00 – 9:00	Executive Session	
9:00 – 9:30	Fermilab Program Overview	M. Witherell
9:30 – 12:30	Overview Technical Presentations by D0	
	Project Overview (Kotcher)	35 minutes
	Silicon Overview (Demarteau)	25 minutes
10:00 – 10:15	BREAK	15 minutes
	Trigger Overview (Wood)	25 minutes
	Silicon Mechanical (Cooper)	20 minutes
	Silicon Electronics & Readout (Nomerotski)	20 minutes
	Level 1 Calorimeter Trigger Upgrade (Evans)	20 minutes
	Level 1 Track Trigger Upgrade (Narain)	20 minutes
12:30 – 1:30	LUNCH	
1:30 – 4:30	Overview Technical Presentations by CDF	
	Run IIb Project Overview (Lukens)	30 minutes
	Silicon Detector – Design and Scope (Flaugher)	30 minutes
	Silicon Detector – Cost and Schedule (Bacchetta)	30 minutes
3:00 – 3:15	BREAK	15 minutes
	Preradiator Replacement (Houston)	20 minutes
	DAQ / Level 3 (Paus)	20 minutes
	Electromagnetic Timing (Toback)	20 minutes
	Installation (Roser)	20 minutes

4:45 – 5:00	BREAK
5:00 – 6:30	Executive Session
7:00	Cocktails then Dinner

Wednesday, April 17

8:00 – 9:30	Meet with CDF / D0 together: Similarities and Differences
9:30 – 10:30	D0 Cost/Schedule/Management Discussions (same subjects as Monday morning)
10:30 – 10:45	Break
10:45 – 12:30	D0 Cost/Schedule/Management Discussions (same subjects as Monday morning)
12:30 – 1:30	LUNCH
1:30 – 3:00	CDF Cost/Schedule/Management Discussions (same subjects as Monday afternoon)
3:00 – 3:15	Break
3:15 – 5:30	CDF Cost/Schedule/Management Discussions (same subjects as Monday afternoon)
5:30 – 6:30	Executive Session

Thursday, April 18

8:30 – 9:30	Executive Session
9:30 – 10:30	Final Breakout Discussions
10:30 – 12:30	Prepare Closeout Materials
12:30 – 2:00	LUNCH & Dry Run
2:00 –	Closeout