Acquisition Execution Plan

Run IIb CDF Detector Project
and
Run IIb D-Zero Detector Project

at
Fermi National Accelerator Laboratory

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Concurrences:

Patrick T. Lukens date
Run IIb CDF Project Manager

Jonathan Kotcher date
Run IIb D-Zero Project Manager

Alfred T. Goshaw date
CDF Cospokesperson

Gerald Blazey date
D-Zero Cospokesperson

Nigel S. Lockyer date
CDF Cospokesperson

W. John Womersley date
D-Zero Cospokesperson

Michael S. Witherell date
Fermilab Director

Paul R. Philp date
DOE Run II Project Manager

Jane L. Monhart date
Fermi Area Office Manager
(Contracting Officer)

Michael P. Procario date
DOE Program Manager

John R. O'Fallon date
High Energy Physics Div. Director

S. Peter Rosen date
Acquisition Executive

Raymond L. Orbach date
Office of Science Director

James A. Rispoli date
Office of Engineering and Construction Management Director
for OMBE

Approved:

Robert G. Card date
Under Secretary for Energy, Science and Environment

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Introduction

This document describes the Acquisition Execution Plan for the Run IIb upgrades to the CDF and D-Zero detectors operating at the Fermi National Accelerator Laboratory (Fermilab) Tevatron Collider. The CDF and D-Zero detectors are large, highly integrated systems of charged and neutral particle detectors designed to observe the proton-antiproton collisions at the Fermilab Tevatron Collider. The detectors were designed, assembled, and are now operated by two collaborations of physicists from U.S. universities, DOE national laboratories, and foreign institutions. The collaborations analyze the collected data and publish the results of these analyses.

The upgrade of each detector will be considered to be a separate project. The two projects are very similar from a technical and managerial point of view. Therefore, the common procurement issues between these projects motivate a single Acquisition Execution Plan to cover both projects. Specific differences between the two projects will be discussed in Appendices A and B.

A. Acquisition Background and Objectives

1. Statement of Need

The purpose of this acquisition is to provide technical components to upgrade the CDF and D-Zero detectors to enable them to accumulate sufficient integrated luminosity to maximize the chance for discovering the Higgs Boson. The Higgs Boson is thought to be responsible for breaking the Electro-Weak symmetry, giving rise to particle masses. Understanding the mechanism for Electro-Weak Symmetry Breaking has been identified as the highest priority of the US High Energy Physics (HEP) program in the recent sub-panel report commissioned by the High Energy Physics Advisory Panel (HEPAP) to assess the long-range future of the field. There are strong indications that the Higgs mass is likely to be within the range where CDF and D-Zero detectors are sensitive to it provided the detectors collect sufficient integrated luminosity.

The Fermilab Tevatron provides the highest energy particle beams in the world, enabling unique opportunities for scientific discovery. Fermilab will continue to operate at the "Energy Frontier" until the Large Hadron Collider (LHC) at the European Organization for Nuclear Research (CERN) begins operation with a much higher beam energy at the earliest in late FY2007. Thus, the Fermilab Tevatron Collider has a window of opportunity for making a major scientific discovery before handing off the baton to CERN. Estimates indicate that, due to radiation damage, the current silicon detectors will only be useful up to 4 fb^{-1}, which is expected to occur in about 2005. The detector components provided by the Run IIb upgrades will allow the detectors to operate at high luminosity and meet the laboratory's goal of acquiring an integrated luminosity of 15 fb^{-1}. This is a significant increase above the Run IIa goal of 2 fb^{-1} and will enable a sensitive search for the Higgs Boson, which has been identified as a top priority by the HEPAP in its recent sub-panel report.

The management of the Run IIb upgrade projects is the responsibility of the Fermilab and is carried out by the CDF project manager and collaboration management team and the D-Zero project manager and collaboration management team.

Regarding procurements, each collaborator is responsible for their own procurements in conformance with their individual procurement rules and requirements. While collaborators are not required to submit individual Acquisition Procurement Plans (APP), all procurements are done with the participations by the Run IIb upgrade project managements. This participation is in the form of having "final say" regarding the individual specifications and schedule for each procurement in question. The DOE approved procurement system at Fermilab will be used for procurement on these projects.

2. Applicable Conditions

Installation of the Run IIb projects will be required to continue operation beyond 2005, due to radiation damage to the current silicon detectors and to optimize data taking with the increased beam intensities.

Considerable experience in the construction and operation of detector elements similar to those included in the Run IIb projects was gained by both collaborations during the Run IIa CDF and D-Zero Upgrade Projects (CD-4 achieved February 20, 2001). The new system designs will draw heavily on that experience.

3. Cost and Funding

The total project costs for the CDF and D-Zero projects have not yet been baselined. The pre-baseline estimated total project cost for the CDF upgrade project is expected to be in the range $27M to $33M with contributions from DOE High Energy Physics of approximately $24M to $29M, and other contributions from foreign countries and U.S. university research programs of $3M to $4M.

The pre-baseline estimated total project cost for the D-Zero upgrade project is expected to be in the range of $30M to $35M with contributions from DOE High Energy Physics of about $26M to $30M, contributions from National Science Foundation (NSF) of about $3M in the form of Major Research Infrastructure (MRI) grants, and other contributions from foreign countries and U.S. university research programs of $1M to $2M. The table below shows the currently estimated funding ranges. Note that the silicon trackers in both projects represent approximately 80 percent of the projects' total cost estimates.

The projects will receive the majority of the funding from DOE via the Fermilab budget. Contributions from foreign sources are anticipated. In addition, several university groups will contribute to the projects and be supported by National Science Foundation grants. Labor for the Run IIb Collider Detector projects will be provided by Fermilab and university supported researchers. Additional details are provided in Appendices A and B. Currently estimated funding ranges for the projects are presented in the table below. The Run IIb CDF and DØ Project Managers, in cooperation with the CDF and DØ cospokespersons and Fermilab directorate, will be responsible for coordinating the general source categories, e.g., foreign sources, university groups, and grants. Cost contingency will be included in the projects baselines to help minimize the impact of funding from some non-DOE sources not materializing. Likewise, if additional funding from non-DOE funding is secured, these additional funds may serve as contingency for the projects.

Currently Estimated Funding Ranges (AY M$)						
	FY01	FY02	FY03	FY04	FY05	Total
CDF						
DOE Equipment	0	3.5	3.5	12.2-14.1	1.8-6.9	21.0-28.0
TEC	**0**	**3.5**	**3.5**	**12.2-14.1**	**1.8-6.9**	**21.0-28.0**
DOE R&D	0	1.7	0.5	1.8-2.5	0	4-4.7
Foreign Contributions	0	0.3	1.8	0.4	0	2.5
U.S. Universities	0	0.1	0.4	0.2-0.2	0	0.6-0.7
TPC *	0	5.6	6.2	14.6-17.3	1.8-6.9	28-35
DØ						
DOE Equipment	0	3.5	4.1	11.6-14.0	4.5-6.1	23.7-27.7
TEC	**0**	**3.5**	**4.1**	**11.6-14.0**	**4.5-6.1**	**23.7-27.7**
DOE R&D	0	1.5	1.0	0	0	2.5
Foreign Contributions	0	.2	.2	.1-.1	0	.5-.6
NSF–MRI silicon	0	1.3	.9	.3	0	2.5
NSF–MRI trigger	0	0	.1	.5	0	.6
U.S. Universities	0	.2	.2	.1-.1	0	.5-.6
TPC **	**0**	**6.7**	**6.5**	**12.6-15.0**	**4.5-6.1**	**30-35**

*Approximately 50 percent of the foreign contributions to CDF will come in the form of contributed goods, i.e., "in kind." The remaining half will be in the form of cash which will pass through the Fermilab Procurement Department. This portion will be subjected to the same procurement procedures used for DOE funds.

** All foreign contributions are in kind, applied toward the trigger. Both the silicon and trigger Major Research Instrument (MRI) grants from the National Science Foundation are approved, with spending having begun for the silicon MRI. Remaining in kind funds are from US university support of engineering and other technical personnel.

Over the life of the project, it is anticipated that DOE, via the management of the CDF and D-Zero upgrade projects at Fermilab, will procure components and services in a range between $12M to $14M for CDF upgrade project and between $13M to $15M for D-Zero upgrade project. This document describes the procurement process to be used by Fermilab in acquiring the goods and services.

Life-cycle cost: The elements of the detectors built by the Run IIb projects will have a useful life of approximately five years.

Design-to-Cost: Laboratory management provided design-to-cost guidance. Designed to meet both specifications and stay within allocated budget. The objective is to get the best design for the dollar.

Application of should-cost: Although this effort does not explicitly use a detailed, special form of cost analysis as identified in Federal Acquisition Regulation 15.407-4, it has used an extensive amount of should-cost philosophy in preparing estimates. Detailed cost estimates of each of the major procurements for the Run IIb projects have been made from vendor quotes and experience with earlier and similar procurements. As a result, these cost estimates will serve as the should-cost benchmarks as these projects evolve and be utilized to estimate project procurement costs and explain any variances.

4. Capability

The capabilities of all services suppliers will be described in the procurement documents for these services, which will be available from Fermilab Purchasing Office. The performance and compatibility requirements for all procured items are described in the preliminary Technical Design Report for the CDF Run IIb upgrade, and the preliminary Technical Design Report for the D-Zero Run IIb upgrade.

5. Delivery or Performance Period Requirements

The basis for establishing delivery and performance period requirements is derived from the project schedule, described in the CDF Project Management Plan and the D-Zero Project Management Plan. Important milestones for the projects are listed below.

Milestone	Date Range
CD-0 Approval	May 2001
CD-1 Approval	October – December 2002
CD-2 Approval	October-December 2002
CD-3 Approval	December 2002 – February 2003
Begin major procurements*	December 2002 – February 2003
Begin Assembly	October 2003
CD-4 Approval	November 2006

*Subsequent to CD-3 approval.

6. Trade-offs

The nature of the projects involve significant scientific and technical expertise with the existing detectors at Fermilab as well as expert knowledge of high energy physics. This expertise is only found within the laboratory workforce who are currently performing the research, development, engineering and experimentation on the detectors and no other entity has the ability to execute the upgrades. Additionally, it is the mission of Fermilab and the URA to execute these types of projects and simultaneously increase the knowledge of detector technology. Finally, the modifications will be to in-place and operating systems that require intimate knowledge of and interaction with other laboratory organizational elements, which no other entity has the ability to accomplish.

Relying on Fermilab's M&O contractor, URA, to function as prime contractor for the projects best facilitates the collaborations' involvement, since the only natural point of contact for this diverse group is at the Laboratory. Laboratory construction projects are within the scope of the URA/DOE contract, and URA has successfully managed this type of technical procurements in the past in its management and operations role at Fermilab. Fermilab's M&O contractor is best suited to complete these projects in the most effective, economical and timely manner. Use of the existing M&O contractor and its existing DOE-approved procurement system versus hiring new people to perform the procurement function will help minimize cost, schedule and technical risks of the projects. The final selection of this acquisition strategy was also based on other significant factors, in particular, the availability of existing laboratory project, technical, administrative, and support staff to support the projects' needs.

7. Risks

Detector upgrades are well within the experience and expertise of the CDF and D-Zero collaborations, Fermilab, and DOE's Fermi Area Office. Technical, cost, and schedule risks have been minimized and are manageable. Every effort has been made to specify these projects in a manner that reduces the level of risk to an acceptably low level. Risk identification and analysis will continue throughout the life of the project. Risks evaluated in ten areas presented in the February 14, 2002, Carnes memo are presented below. Risks in all ten areas are low and also have additional risk mitigation options as outlined below. Specific examples of risk mitigation for the highest risk items of the upgrades are listed in point 5 below. These risks will be manageable.

In addition to these areas, comprehensive analysis of cost, schedule, technical, and scope risks has been systematically performed. The results of this analysis and actions taken to address risks will be presented at the baseline readiness review in September, 2002, conducted by the Office of Science. No items with high likelihood of occurrence and high consequence were identified. Risk identification and management will be an ongoing process throughout the life of the projects.

(1) Project scope and definition:

The scope of the projects is well defined. Knowledge gain during the operations of the current detectors could influence the scope, but this risk is considered to be very low.

(2) Environment, Safety and Health:

ES&H risk is very low on these projects. NEPA for the projects is covered by Categorical Exclusion and the work to be conducted at the Fermilab site will be covered under Fermilab's existing Integrated Safety Management Program. ES&H in regard to the components produced by these projects will be similar to the existing detectors which are covered by Safety Assessment Documents.

(3) Cost and Schedule range:

Use of fixed-price subcontracts and competition will be maximized to reduce cost risk.

Schedule risk will be minimized via:

- realistic planning,
- verification of subcontractor's credit and capacity during evaluation,
- close surveillance of subcontractor performance,
- advance expediting, and
- incremental awards to multiple subcontractors when necessary to assure total quantity or required delivery.

(4) Project funding range and budget management:

Funding for the projects comes from a number of sources, including foreign countries. Funding may change as the projects progress. Cost contingency will be included to help mitigate this risk. Likewise, if additional funding from non-DOE sources is secured, these additional funds will serve as contingency for the projects. Non-DOE funding will be controlled via Memoranda of Understanding between Fermilab and the collaborating institutions. Fermilab has a 20-year history of excellent foreign support on detector collaborations.

(5) Technology status and engineering:

Preparation of clear and concise specifications, judicious determination of subcontractor responsibility and approval of proposed lower tier sub-subcontractors, and implementation of QA provisions will minimize technical risk. Projects have been designed to further minimize technical risk by exploiting previous experience to the greatest extent possible, and minimizing exposure to single vendor failures. Technically risky elements of the silicon detectors for both detectors have been minimized by making deliberately conservative design choices. For example, use of single sided sensors, reduction in component variety, and common integrated circuit technologies will reduce risk.

Specific examples of risk mitigation are given below for the highest risk items in the project: 1) the Layer 0 flex analogue cables; 2) SVX4 readout integrated circuit; and 3) silicon sensors.

The Layer 0 flex cables pose a technical challenge because of the difficulty in fabricating cables with the required spacing between conductors. To mitigate this risk, an extensive search has been conducted of potential vendors and prototype cables have been ordered from multiple vendors. Since two vendors have demonstrated the ability to produce these cables, the technical risk has been reduced to an acceptable level.

The SVX4 readout IC's are custom integrated circuits that are being designed specifically for the CDF and D-Zero upgrade projects by integrated circuit designers at Fermilab and LBL. One technical risk is that the SVX4 IC will not operate as designed. This risk has been mitigated by fabricating prototype SVX4 Readout IC's and demonstrating that the design requirements were met. A second technical risk is that additional labor will be required for the design and testing of the chip. This risk has been mitigated by identifying an additional chip designer at Fermilab who could be reassigned to the project if necessary.

The silicon sensors are the detecting element for the silicon detectors and must operate reliably in a high-radiation environment. The technical risk has been mitigated by conservative design practices that utilize well established technology. Risk has been further mitigated by procuring and extensively testing prototype sensors, including radiation damage testing.

(6) Project interfaces and integration requirements:

The technical components produced by these projects will be installed in existing detectors, the constraints of which are well understood. The most significant source of interface or integration risk will be during the assembly of the silicon trackers at Fermilab's Silicon Detector Facility. Analysis of manpower needs show that Fermilab will be able to provide the needed manpower during this period.

(7) Safeguards and security:

Safeguards and security will be covered under Fermilab's existing DOE-approved program and Fermilab has experienced no major incidents in the past. Therefore, risk in this area is low.

(8) Project location and site conditions:

Fermilab has the infrastructure, e.g., clean rooms and technical equipment, in place to complete the assembly of these projects on site. This risk is very small.

(9) Legal and Regulatory assessment:

No legal or regulatory problems are foreseen, and Fermilab has historically completed contracts/projects with minimal exposure to claims. Therefore, this risk is small.

(10) Stakeholder issues:

The stakeholders of these projects are the CDF and D-Zero Collaborations. Members of these collaborations are intricately involved in the design and management of these projects. This risk is therefore very small.

8. Acquisition Streamlining

This acquisition has not been designated by DOE for streamlining.

B. Plan of Action

1. Sources

The sources for procuring the Run IIb CDF and D-Zero Detector Projects are limited because they require expertise that does not exist in industry and because they modify and must be tightly integrated into the existing CDF and D-Zero detectors. The Project Managements have reviewed and evaluated the feasible acquisition alternatives. Based on Fermilab's extensive expertise, strong in-house capabilities, and unique knowledge of the existing detectors, the Project Managements have selected an acquisition strategy whereby Fermilab oversees the procurement and assembly of components into the subsystems that form the Run IIb detector projects.

The Run IIb CDF and D-Zero Detector Projects require the procurement of a wide variety of components that are assembled into the detector subprojects listed in Tables A-1 and B-1 below. The primary source of materials for these projects will be commercial vendors vying for purchase orders under competitive conditions. Some components will be provided by universities or foreign-funding sources under MOU developed by Fermilab. Ultimate technical, schedule, and cost will be controlled by the project team. Labor will come from both university and Fermilab staffs. Davis Bacon Act requirements will be applied appropriately.

Three major procurements are identified as critical to the projects where there are limited commercial sources: silicon sensors, SVX4 readout IC's, and Layer 0 analog flex cables.

Silicon Sensors: The largest single procurements for the projects with cost range of \$1.5M to \$2M per detector. The sources under consideration include Hamamatsu Photonics, Elma, STMicroelectronics, and Micron Semiconductor.

SVX4 readout IC: Custom integrated circuits, designed specifically for the CDF and D-Zero upgrade projects by integrated circuit designers at Fermilab, LBL, and INFN Padova. Since each integrated circuit foundry has different design rules, it was necessary to target the design for a particular vendor at an early stage in the design process. An evaluation of the technical capabilities of potential vendors to fabricate the SVX4 readout IC's with the required properties was performed. Based on this evaluation, it was decided to target the design for fabrication by Taiwan Semiconductor Manufacturing Corporation (TSMC).

Layer 0 analog flex cables: The sources under consideration include Dyconex and Keycom.

2. Competition

All actions will be competitive unless specifically authorized by the project managers and in accordance with the DOE-approved Fermilab procurement policies and procedures.

As for the SVX4 readout IC, in the unlikely event that TSMC encounters unforeseen difficulties and it unable to produce these integrated circuits, the design would be reworked to target an alternate vendor. Given the successful fabrication of prototype already being produced and tested, and production capability of TSMC, there is very low, if any, procurement risk to this item.

3. Source Selection Procedures

The source selection for all procurements is guided by Fermilab procurement procedures.

(1) Competition

Fixed-price purchase orders and subcontracts for supplies, equipment and services will be awarded on the basis of competitive solicitations. Such awards shall be made to offerors deemed technically responsive and responsible by project and procurement representatives. Awards made on a non-competitive basis will include adequate justification to support such award in accordance with Fermilab procurement procedures. For critical components required in quantity, multiple contracts with options exercisable by Fermilab may be utilized to obtain best value.

(2) Solicitation Documents and Evaluation Criteria

The means of soliciting offers will be the Request for Quotation (RFQ) and the Request for Proposal (RFP). The nature, complexity and/or dollar value of each procurement will determine the type of solicitation to be used.

All major or highly technical procurements will, when appropriate, have a plan for evaluating proposals and evaluation criteria for ranking of prospective vendors or subcontractors who are competing. Criteria for evaluation will be based on technical, business and overall cost factors including technical capability, past performance, capacity, and delivery, as well as subcontractor responsiveness to the solicitation and subcontractor responsibility factors such as financial means.

These evaluation criteria will relate directly to the specification and/or Statement of Work. The plan will include the criteria for the technical evaluation. Evaluation criteria will be established prior to the distribution of the solicitation. The general criteria will become a part of the solicitation so that all potential offerors will reasonably know how the proposals will be evaluated.

4. Contracting Considerations

A Statement of Work (SOW) or specification will be required for all procurement actions. The content and detail of each SOW or specification will fully define or describe the proposed procurement.

(1) Functional or performance specifications will be used, to the extent practicable,

for procurement of materials and services.

(2) Consolidation and standardization: It is the intent of the project to consolidate standard like-items in order to reduce the number of orders handled and to obtain quality or volume discounts as long as delivery and schedule can be met.

(3) Special Provisions: Except for the utilization of unilateral options as discussed in section B.3 (Source Selection Procedures) above, the project does not anticipate that special contractual provisions will be required for this project.

5. Budgeting and Funding

The budgeted cost ranges from $3M to $4M for silicon sensors, $1.5M to $2M for SVX4 readout IC, and $1.4M to $1.8M for Layer 0 analog flex cables. This budget and procurement plans are consistent with the overall project schedule and funding profile.

6. Product or Service Descriptions

Each project will deliver a completed radiation hard silicon tracking detector for use in Run IIb. These detectors are the largest single subprojects in each project. Other smaller deliverables are detailed in Appendices A and B. All services to be procured are fixed-price, level of effort contracts, spread out over multiple procurements. This allows the project managements to maintain control of the quantity and quality of effort.

7. Priorities, Allocations and Allotments

There are no unique priorities, allocations or allotments associated with the procurement of the Run IIb collider projects.

8. Contractor vs. Government Performance

DOE and Fermilab will provide project management. The majority of the work associated with the Run IIb projects will be performed by contractor (Fermilab) or subcontractor personnel. Fermilab will award all contracts to commercial firms, universities, and research laboratories. There is no apparent advantage for DOE to directly handle the Run IIb procurements (see Trade-offs section for further details). Fermilab will conduct the acquisition and ES&H functions, with support and oversight from DOE.

9. Inherently Governmental Functions

There are no inherently governmental functions associated with the Run IIb projects.

10. Management Information Requirements

Project procurements will include status reporting requirements. The projects will maintain a comprehensive procurement follow-up program tracking all aspects of the procurement cycle. Earned value details will be required from vendors on major procurements that include progress payment provisions.

11. Make or Buy Considerations

Fermilab will comply with the Make or Buy Program set forth in the DOE/URA prime contract.

12. Test and Evaluation

The project teams will determine the items to be procured. The teams will develop technical requirements and specifications, including test and evaluation requirements.

13. Logistic Considerations

No unique logistical considerations are anticipated for the Run IIb projects. Standard DOE warranty practices will be applied regarding the procured materials. Standard DOE data requirements will be imposed on both the materials and services suppliers.

14. Government Furnished Property

No government-furnished property is anticipated on these projects. If the need arises in the future, it will be provided in accordance with the DOE-approved Fermilab property management system.

15. Government Furnished Information

These projects do not anticipate making use of any government supplied information.

16. Environmental and Energy Conservation Objectives

The energy needs and environmental impact of these projects is negligible. No specific objectives have been identified.

17. Security Considerations

There are no extraordinary security concerns; none of the work is classified. The security oversight for the overall site is Fermilab's responsibility. Access to and from the job site is controlled by standard site access requirements.

18. Safety Requirements and Considerations

Fermilab subscribes to the philosophy of Integrated Safety Management (ISM) for all work conducted on the Fermilab site and requires its subcontractor and sub-tier contractors to do the same. Integrated Safety Management is a system for performing work safely and in an environmentally responsible manner. The term "integrated" is used to indicate that the ES&H management systems are normal and natural elements of doing work. The intent is to integrate the management of ES&H with the management of the other primary elements of work: quality, cost, and schedule.

19. Contract Administration

The DOE Run II Project Manager will monitor and evaluate project performance against technical, cost, and schedule baselines as specified in the Project Execution Plan. Environment, safety and health performance will also be monitored via the existing Fermi Area Office ES&H oversight program.

The Fermilab Procurement Department established within the Business Services Section will implement all aspects of procurement using DOE-approved Fermilab procurement policies and approval authority guidelines.

Authorization to approve purchase requisitions, stores requests and service requests will be controlled by the Fermilab signature authorization system. The Procurement Department will procure all material, fabricated items, equipment, and services. It will also subcontract Research and Development authorized by either the Project Manager or Project personnel possessing the requisite signature authority.

The manager of the Procurement Department will assign specific procurements to Procurement Administrators having the skills and expertise to best handle the requirement.

The Procurement Department will be responsible for administering the pre-solicitation, solicitation, evaluation, negotiation, award, and subcontract administration activities, including expediting and close-out.

20. Other Considerations

Several of the more technically challenging and/or riskier elements to be procured by the two projects are being closely coordinated, in order to reduce the schedule risk and cost in the procurements. Specific examples include the SVX4 readout chip, which will be used in the silicon detectors of both detectors and the silicon sensors. Technically risky items have been scheduled with extra contingency in both time and cost, in the event that extra prototype cycles are required.

21. Milestones in the Acquisition Cycle

The significant milestones for procurement are detailed in Appendix A and B.

22. Integrated Project Team

The following is the initial membership of the Run IIb CDF and D-Zero Detector Projects Integrated Project Team. This team participated in the writing of the Acquisition Execution Plan.

Mike Procario, DOE Program Manager
Paul Philp, DOE Run II Project Manager, IPT Lead
Patrick Lukens, Run IIb CDF Project Manager
Jon Kotcher, Run IIb D-Zero Project Manager
Doug Benjamin, Run IIb CDF Deputy Project Manager

Rich Partridge, Run IIb D-Zero Deputy Project Manager
Joe Collins, Fermilab Procurement
Ed Temple, Fermilab Project Oversight

Appendix A: The Run IIb CDF Detector Project

The CDF detector is the older of the two detectors and is located on the interaction point designated as "B0" by the accelerator group. Three primary subprojects are anticipated for the Run IIb project to provide equipment to replace existing equipment that will no longer meet the needs of the collaboration: a silicon detector, a central preradiator detector, and upgraded data acquisition and trigger systems. The current cost estimate with contingency is given in Table A-1 for primary subprojects.

Table A-1: Estimated Cost for the CDF Run IIb Project Primary Subprojects

Subproject	Estimated Cost (in M$)
Silicon Tracker	$17-22
Calorimeter Upgrades	$1.4-1.6
Data Acquisition Upgrades	$7.6-8.6

Procurement Milestones

A list of the procurement milestones anticipated for the CDF Run IIb project with current estimated bid release dates appears in Table A-2. Most of these procurements have estimated costs exceeding $100,000.

Table A-2: Procurement Milestones in Fiscal Years 2003-05

Description	Bid Release Date
SVX4 Chips	May 2003
Outer Layer Hybrids	January 2004
Layer 0 Hybrids	May 2003
Bus Cables	July 2003
MiniPortcards	January 2004
Cables	May 2004
Fiber Transition Module	December 2004
Power Supplies	January 2004
SVT Trackfitters	October 2004
Sensors	December 2002
Layer 0 Cables	August 2003
Phototubes and Bases	December 2002
32 Port ASX 4000	July 2004

CDF is an international collaboration of 55 institutions, representing ten countries. It is anticipated that a number of procurements needed for the project will be made through collaborating institutions, due to the technical expertise available. Memoranda of Understanding (MOU) will be established with the collaborating institutions to establish responsibilities for the procurements they coordinate. In every instance where a collaborating institution provides goods or services to the project, the Memorandum of Understanding established between Fermilab and the institution will assure that the Project Manager has oversight of the work performed and can establish specifications for acceptance of the work or goods provided.

Appendix B: Run IIb D-Zero Detector Project

The D-Zero detector was first brought into operation in 1992 and had a very successful "Run I" data run during 1992-1996. The detector underwent a major upgrade, completed in 2001, in preparation for the Run IIa data run which will continue until approximately 2005.

The goal of the D-Zero Run IIb upgrade is to provide equipment to extend the usable lifetime of the detector and allow operation at high luminosities required to meet the goals of the Run IIb physics program outlined in Section A.1 (Statement of Need). The largest of the upgraded equipment provided by this project is the Silicon Tracker replacement, which is needed because of the significant radiation damage to the present silicon tracker during Run IIa. In addition, equipment is provided to upgrade the trigger and online systems to allow operation at the high luminosity expected in Run IIb and upgrades to the online computing system to provide continued operation. Table B-1 lists the estimated cost of these upgrades (including contingency).

Table B-1: Estimated Cost for the D-Zero Run IIb Project Primary Subprojects

Subproject	Estimated Cost (in M$)
Silicon Tracker	$22-25
Trigger	$4.5-6
DAQ/Online	$1.5-2

Procurement Milestones

A list of the procurement milestones anticipated for the D-Zero Run IIb project with current estimated bid release dates appears in Table B-2. Most of these procurements have estimated costs exceeding $100,000.

Table B-2: Procurement Milestones in Fiscal Years 2003-05

Description	Bid Release Date
Layer 0 Sensors	February 2003
Layer 1 Sensors	February 2003
Layer 2-5 Sensors	January 2003
SVX4 Readout IC's	May 2003
Layer 0 Hybrids	April 2003
Layer 1 Hybrids	June 2003
Layer 2-5 Hybrids	June 2003
Analog Flex Cables	June 2003
Digital Jumper Cables	March 2003
Adapter Cards	February 2004
Twisted-Pair Readout Cables	April 2004
Digital Filter Parts	November 2003
Trigger Algorithm Parts	November 2003
Track Trigger FPGAs	May 2004

Over 600 physicists from 73 institutions in 18 countries are currently members of the D-Zero collaboration that utilizes the data acquired by the D-Zero detector for producing scientific results. Many of the collaborating physicists and institutions have played major roles in the construction of the present D-Zero detector and in the planning for the Run IIb upgrade. Many elements of the Run IIb upgrade require highly specialized expertise for design and construction that can only be obtained in the collaborating institutions.

In addition to DOE funding, the D-Zero Run IIb project is partially supported by NSF and D-Zero collaborating institutions. As a result of this outside support, some procurements will be performed by these collaborating institutions. Memoranda of Understanding (MOU) will be executed between Fermilab and collaborating institutions that detail the work to be performed by each institution. The MOU will also describe the approval process for procurements to ensure full oversight by the Project Manager. Two NSF Major Research Instrument (MRI) grants have been awarded for the D-Zero Run IIb project. They provide partial funding for the Silicon Tracker Replacement and the Trigger Upgrade. In addition to the NSF funding, cost sharing funds have been committed to the project by the collaborating universities and foreign institutions.