# Recycler 2.5 MHz RF System

Project Execution Plan

April 2013

Fermilab

Fermi National Accelerator Laboratory

A Department of Energy National Laboratory

Managed by Fermi Research Alliance, LLC

The Project Execution Plan (PEP) describes the management, control systems, and procedures used by Fermi National Accelerator Laboratory (Fermilab) to meet the technical, cost, and schedule objectives of this project. This controlling document establishes the basis against which progress will be measured.

The PEP is to be viewed as a "living document," and as such, will be revised when necessary. The Project Manager is authorized to approve non-substantive changes to the PEP (e.g., name changes to the positions cited in the PEP), but will inform the DOE Project Director via e-mail of such changes. Baseline changes will require approval by the Department of Energy's (DOE) Fermi Area Office.

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## A. Submittal Page

Submitted, Accepted, and Approved by:

— Not required —
Michael J. Weis Date

DOE Area Office Manager
Fermi Area Office

— Not required —
Paul Philp Date

DOE Project Director
Fermi Area Office

4/23/13
Stuart Henderson Date

Associate Director
Fermilab Directorate

4/18/13
Roger Dixon Date

Accelerator Division Head

4/17/13
Mary Convery Date

Muon Campus Program Coordinator

04/15/2013
Ioanis Kourbanis Date

Project Director

04/15/2013
Ioanis Kourbanis Date

Project Manager

## B. Project Objectives

The Fermilab Recycler is a 3.3 km proton storage Ring using permanent magnets. It will be used for slip stacking 12 Booster batches and then injecting in the Main Injector thus reducing the MI Cycle to 20 Booster ticks from 33. Since slip stacking only takes 13 Booster ticks, Recycler will be available for beam delivery to the muon campus experiments. In order to provide the required longitudinal beam structure for the muon campus experiment 80 KV of 2.5 MHz RF are required in the Recycler. The Recycler 2.5 MHz project is an $8.6M effort that is designed to provide the RF system required for the longitudinal beam structure for the muon campus physics experiments.

## C. Project Scope

The Recycler 2.5 MHz project will assemble and install 7 2.5 MHz cavities and associated RF amplifiers, controls, cooling, and support hardware within the Recycler. Two extra "bare" 2.5 MHz cavities will be assembled.

## D. Project Organization Structure

**DOE Management**

The Fermi Site Office administers the M&O contract with FRA for operations of Fermilab and exercises oversight of Fermilab. The Fermi Site Office Manager, Michael J. Weis, has been delegated responsibility and authority for execution of the project. The specific responsibilities of the Fermi Site Office manager are:

- Supervision of DOE Project Director and Fermi Site Office staff;
- Review of and concurrence with this Project Plan;
- Review and approval of documents as required by federal regulations or departmental orders or notices;
- Approval of Fermilab subcontract actions, within the authority delegated to Fermi Site Office;

Funds will be made available to DOE for the project on an annual basis following passage of legislation in the U.S. Congress.

The Fermi Site Office Manager has delegated authority and responsibility for management and direction of the project to the DOE Project Director, Paul Philp. The specific responsibilities of the DOE Project Director include:

- Review of this Project Plan and changes thereto
- Measurement of performance against established goals including technical performance, cost levels, and schedule milestones
- Making any necessary changes or as it pertains to taking corrective actions within the appropriate thresholds established in this Project Plan.
- Overseeing Fermilab's management of installation activities .
- Monitoring project progress via reports prepared by the Project Manager.

The DOE has delegated the responsibility for this project to Fermilab.

**Fermilab Management**

This project will be managed based on the guidance provided in DOE Manual 413.3-1. Other DOE Order and Manuals, especially regarding design, engineering, contingency and indirect costs have been used to determine the basis for estimating costs and establishing baselines. This identification, implementation and compliance with other relevant Orders, Manuals and requirements are the responsibility of the Integrated Project Team (IPT).

The IPT structure shown in Figure 1 identifies the organizational structure that will be responsible for procurement and installation of this Project.

As with all activities at Fermilab, the Directorate is at the highest level of responsibility. The Fermilab's Associate Director, Stuart Henderson and the Fermilab Accelerator Division Head, Roger Dixon are the Project Sponsors championing the project. The Project Sponsors establish and approve the mission need and allocate the funds from the Fermilab budget.

Procurement, installation, cost and schedule for this project are the responsibility of the AD. The Accelerator Division (AD) will manage the work associated with this project, as well as accept line management responsibility for safety.

The Project Sponsors have designated Mary Convery of the Accelerator Division as the Muon Campus Program Coordinator (Program Coordinator) and Ioanis Kourbanis of the Accelerator Division as the Fermilab AIP Director (Project Director). The Program Coordinator and the Project Director are key stakeholders that have accepted the scope of work as described within this project's Project Plan. The Program Coordinator will initiate all scope changes and shall secure any additional funding authority as defined by the Fermilab Project Manager and coordinate interaction with other Muon Campus projects.

Fermilab has designated Ioanis Kourbanis (Accelerator Division Main Injector Department) as Project Manager. The Fermilab Project Manager will utilize the resources of the Accelerator Division as appropriate for design, construction, installation, and testing coordination.

All project stakeholders are considered to be organizational project assets and are considered invaluable during the planning and execution of the project. The Program Coordinator and Project Manager will identify those key stakeholders and obtain the relative inputs critical to the project's success.

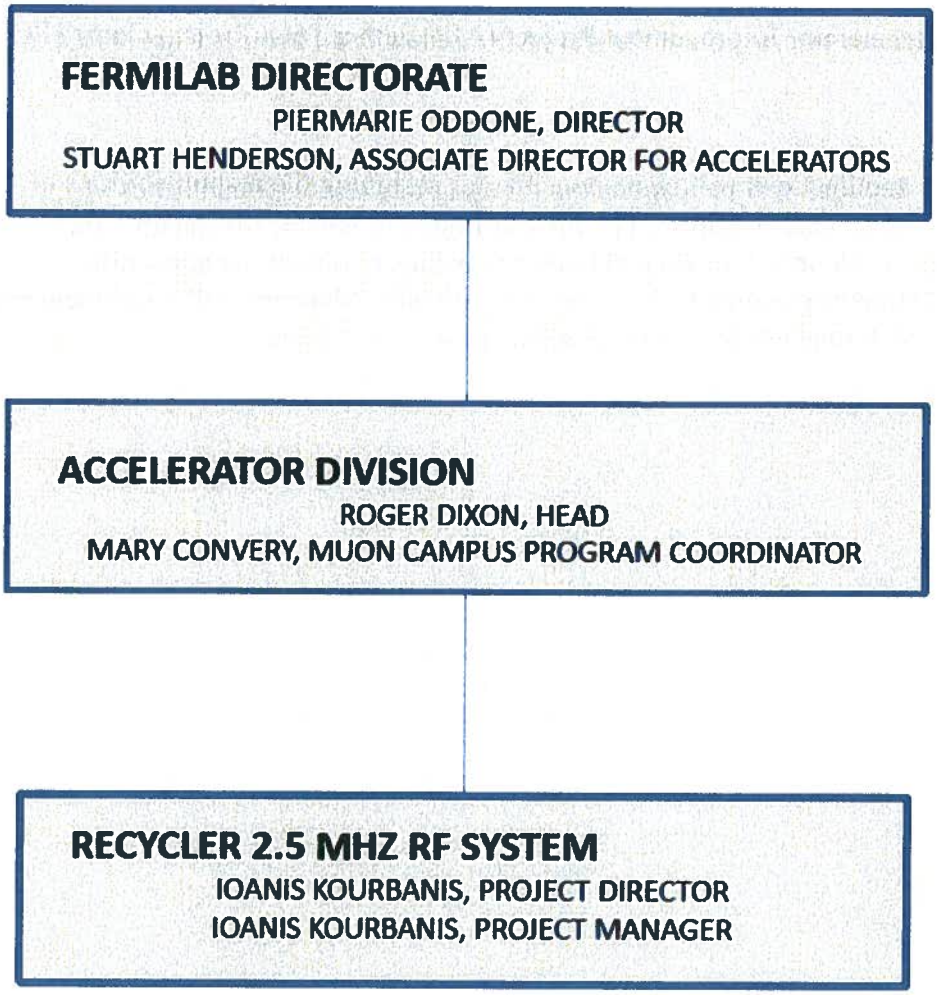
Prospective users, landlord ES&H personnel and building managers are always key stakeholders that are included in the process.

**ES&H Management**

The AD ES&H Department, headed by John Anderson, has the responsibility for providing Environmental, Safety, and Health coordination and oversight of ES&H throughout the project. As with all Fermilab projects, attention to ES&H concerns will be part of the project management and Integrated Safety Management (ISM) will be incorporated into all processes. Line management responsibility for ES&H will be maintained on this project. Safe coordination of installation activities will be accomplished through the Project Manager, Project ES&H Coordinator, Project Engineer, and Task Manager. During installation the Subcontractors, T&M Crafts, and all Fermilab personnel will utilize Project Hazard Analyzes (PHA) to plan all work and mitigate hazards. The Project Manager and Project ES&H Coordinator will audit compliance with all applicable ES&H requirements.

Accelerator Division will be responsible for reviewing the project for NEPA compliance. We expect that the project will comply within the Fermilab Muon Campus Categorical Exclusion (CX) approved by DOE on June 8, 2012.

# ORGANIZATIONAL CHART



## E. Resource Requirements

**Funding**

This project is an Accelerator Improvement Project (AIP) with a Total Project Cost (TPC) of $8,601,165.

**Personnel**

Fermilab Divisions and Sections will be responsible for assigning the responsibilities of individuals within the project organization. The Project Engineer will be responsible for coordinating within the Accelerator Division and other divisions to obtain the appropriate technicians and project support personnel. The Task Coordinator/ Manager will coordinate with the Fermilab Time and Materials office to arrange all necessary craft support.

## F. Project Baseline

The Project Baseline identifies the basis for evaluating project performance. The components are the Work Breakdown Structure, which identifies each component of the project, the Baseline Costs, and Baseline Schedule and Milestones.

**Work Breakdown Structure (WBS) Dictionary**

The WBS will follow the existing Recycler 2.5 MHz RF WBS. Listed below is the breakdown of the WBS for this project. Further breakdown of the WBS may be applied as required for accounting purposes.

| WBS | Name |
|---|---|
| RRF1 | Recycler 2.5 MHz RF AIP |
| RRF1.01 | Recycler Management |
| RRF1.01.01 | Milestones |
| RRF1.01.02 | Recycler AIP Oversight |
| RRF1.02 | RF |
| RRF1.02.01 | Cavities & Power Amplifiers |
| RRF1.02.02 | RF Cooling |
| RRF1.02.03 | Low Level RF |
| RRF1.02.04 | Installation |

For accounting purposes, the contingency of the above listed WBS items will be included in the WBS items. DOE Guide G430.1-1, Chapter 11 was used as guidance in estimating the appropriate contingency for this project.

For accounting purposes, the indirect costs of the above listed WBS items will be included in the WBS items. For reference purposes, Indirect Costs rates are defined by DOE Order 4700.1 that states indirect costs are "...costs incurred by an organization for common or joint objectives and which cannot be identified specifically with a particular activity or project. The multipliers used in this document are based on current Fermilab rates in effect as of January 2013.

**Baseline Project Costs**

Listed below are the baseline project costs for this project.

| WBS | Description | Base Cost with Esc | Contingency | Indirect Costs | Subtotal |
|---|---|---|---|---|---|
| RRF1 | Recycler RF AIP | $4,241,566 | $1,984,885 | $2,374,719 | $8,601,165 |
| RRF1.01 | Recycler RF Management | $124,711 | $74,561 | $123,825 | $323,096 |
| RRF1.01.01 | Milestones | $0 | $0 | $0 | $0 |
| RRF1.01.02 | Recycler RF AIP Oversight | $124,711 | $74,561 | $123,825 | $323,096 |
| RRF1.02 | Recycler RF | $4,116,856 | $1,910,324 | $2,250,839 | $8,278,069 |
| RRF1.02.01 | Cavities & Power Amplifiers | $3,346,372 | $1,582,091 | $1,927,267 | $6,855,726 |
| RRF1.02.02 | RF Cooling | $367,325 | $150,252 | $133,516 | $651,093 |
| RRF1.02.03 | Low Level RF | $120,890 | $60,191 | $79,746 | $260,826 |
| RRF1.02.04 | Installation | $282,269 | $117,790 | $110,365 | $510,424 |
| | Totals | $4,241,566 | $1,984,885 | $2,374,719 | $8,601,165 |

**Escalation**

The baseline estimates have been escalated by task using the following escalation rates:
M&S= 2.7% /year (FY14, FY15, FY16)
SWF= 2.7% /year (FY14, FY15)
The rates utilized for Materials and Service (M&S) are as suggested by the most recent OECM published escalation rates. The escalation rates for Salary with Fringe (SWF, Labor) costs are based on input from the Fermilab Directorate based on our latest understanding of our annual labor costs.

**Baseline Project Milestones**

The baseline milestones listed below sets forth the major activities essential for the completion of the project. Note that tunnel and service building installation milestones are tied to accelerator shutdowns that are outside the control of this project.

| MILESTONE | DEFINITION | BASELINE |
|---|---|---|
| Start Project | Project Plan signed | Month 0 |
| Finish RF Cavity Cooling Tests | | Month 8 |
| Receive all Ferrites | All extra Ferrites required for the assembly of 9 2.5MHz cavities are received. | Month 12 |
| Finish Cavity Assembly | | Month 24 |
| Begin Tunnel Installation | | Month 26 |
| Tunnel Installation Complete | | Month 29 |
| Begin Service Building Installation | | Month 29 |
| Service Building Installation Complete | | Month 30 |
| Project Complete | Project Closed | Month 30 |

## Funding Profile

Listed below is the anticipated total Obligation Profile for this project as contained in the Fermilab Project Request Form.

**Labor**

| | FY13 | FY14 | FY15 | Total |
|---|---|---|---|---|
| SWF Base Escalated | $83,586 | $790,884 | $965,094 | $1,839,564 |
| SWF Indirect Costs | $82,993 | $785,269 | $956,369 | $1,824,658 |
| Subtotal | $166,579 | $1,576,154 | $1,921,490 | $3,664,223 |
| Contingency | $49,974 | $472,846 | $576,447 | $1,099,267 |
| Total | $216,553 | $2,049,000 | $2,497,937 | $4,763,489 |

**M&S**

| | FY13 | FY14 | FY15 | Total |
|---|---|---|---|---|
| M&S Base Escalated | $275,114 | $1,825,475 | $301,412 | $2,402,001 |
| M&S Indirect Costs | $30,035 | $384,892 | $135,132 | $550,058 |
| Subtotal | $305,149 | $2,210,366 | $436,544 | $2,952,058 |
| Contingency | $91,545 | $663,110 | $130,963 | $885,618 |
| Total | $396,693 | $2,873,476 | $567,507 | $3,837,676 |

**Total**

| | FY13 | FY14 | FY15 | Total |
|---|---|---|---|---|
| Base Escalated | $358,700 | $2,616,359 | $1,266,506 | $4,241,565 |
| Indirect Costs | $113,028 | $1,170,161 | $1,091,528 | $2,374,717 |
| Subtotal | $471,728 | $3,786,519 | $2,358,034 | $6,616,281 |
| Contingency | $141,518 | $1,135,956 | $707,410 | $1,984,885 |
| Total | $613,246 | $4,922,475 | $3,065,444 | $8,601,165 |

## G. Acquisition Execution Plan

The project management, construction management, installation and inspection for this project are being performed in compliance with the applicable DOE Orders, Laboratory Policy and Procedures and in accordance with the Work Breakdown Structure.

**Engineering, Design, Inspection and Administration**

Preliminary Engineering designs were performed in conjunction with the research and development efforts and are not included herein. Engineering Design, Inspection and Administration efforts for the fabrication and installation will consist of Fermilab AD and TD personnel.

A Davis-Bacon determination has been prepared for this project and a copy is attached in the appendix.

## H. Project Controls

**Cost Control**

The baseline budget for each element will be shown on all reports. Costs accrued by these accounts will be reported monthly on a report issued by the Finance Section. The Project Manager will review the report and verify the validity of all cost charges during the reporting period that commitments are correct and that projections of costs can be covered by the baseline budget for each work element.

The Project Manager has the responsibility for the use and commitment of project funds. Any costs or commitments that are made without his signed approval or that of higher Laboratory management may be rejected.

The Project Manager, within authorized limits, will be responsible for the administration of the project's contingency's funds.

The Funding Profile, depicted in Section F, is based on the current DOE funding profile. This plan reflects the best estimate of funding levels and the baseline schedule. The Funding Profile establishes the planned rate of obligations for the life of the project. The Project Manager is responsible for updating, as needed, the project Estimate at Completion (EAC) for each work element to reflect changes in design and construction, and for overall project fiscal management.

**Schedule Control**

The Baseline Milestones, shown in Section F of this report, depicts the milestones and their expected achievement dates. The Project Manager shall have the responsibility to monitor and control these tasks within the baseline. The baseline may be revised with DOE Fermi Site Office concurrence, thus the change control process.

**Change Control Procedures and Authorities**

Changes to the project baseline can occur to the scope, cost, or schedule aspects of the project. Changes at WBS Level 1 and below will be made with the approval of the Project Manager for cost changes up to $100,000 and schedule changes up to 3 months. Cost and schedule changes above these amounts and changes to the scope of the project will require the approvals of the Change Control Board. Any change to the Total Project Cost will require the approval of the Change Control Board and DOE Fermi Site Office. Project change control will be accomplished in accordance with practices listed below.

| Change | Approval Required | Change Request Form |
|---|---|---|
| In scope ≤$100k or ≤3 months schedule change | Project Manager | Required |
| In scope >$100k or >3 months schedule change | Control Board | Required |
| Total Project Cost | Control Board<br>DOE<br>Fermilab Directorate | Required |
| Non-Emergency required for ES&H regulations | Control Board | Required |
| Change to Project Scope | Control Board<br>DOE<br>Fermilab Directorate | Required |

The Change Control Board (Control Board) will be comprised of the following named individuals or the designees:

| | |
|---|---|
| DOE Fermi Site Office | P. Philp (non-voting) |
| Fermilab Directorate | S. Henderson |
| Fermilab AD | R. Dixon |
| Program Manager | M. Convery |
| Project Director | I. Kourbanis |
| Project Manager, Chair | I. Kourbanis |

The Project Manager will act as Chair to the Control Board. The Control Board will consider the change requests promptly and, in cases not requiring additional information or discussion, will respond within two weeks.

# I. Design and Construction Principles

**Integrated Safety Management (ISM)**

Fermilab subscribes to the philosophy of Integrated Safety Management (ISM), in accordance with Department of Energy Order 413.3 "Program and Project Management for the Acquisition of Capital Assets." Fermilab requires its subcontractors and sub-tier subcontractors to do the same. ISM is a system for performing work safely and in an environmentally responsible manner. The term "integrated" is used to indicate that the Environment, Safety & Health (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 construction: quality, cost, and schedule.

**Quality Assurance**

All aspects of this project will be periodically reviewed with regard to Quality Assurance issues from Conceptual Design through Title III completion. This review process will be completed in accordance with the applicable portions of the Director's Policy Manual, Section 10. The following elements will be included in the design and construction effort:

- An identification of staff assigned to this project with clear definition of responsibility levels and limit of authority as well as delineated lines of communication for exchange of information;
- Requirements for control of design criteria and criteria changes and recording of standards and codes used in the development of the criteria;
- Periodic review of design process, drawings and specification to insure compliance with accepted design criteria;

**Reliability and Maintainability**

Both reliability and future maintenance are considered in the design of all components of Fermilab site. Materials and construction techniques are selected during the design process to provide adequate design life, accessibility, and minimal maintenance.

**Risk Management**

All potential risks will be identified and tracked to insure that sufficient budget and schedule contingency are incorporated into the baseline plan. These risks will be monitored and reported, at a minimum at the monthly PMG, and retired as appropriate.

## J. Reporting and Reviews

The objective of the reporting and review activity is to provide the assemblage and integration of project related cost data, schedule status and performance progress into reports for the monitoring and management of the project.

**Reporting**

*Daily* – The Project Manager will hold meetings as necessary to discuss progress and issues.

*Quarterly* - The Project Manager will review progress and changes, in order to prepare a Quarterly AIP report.

**Reviews**

Directorate Level Review – If appropriate and requested, the project team will meet with the Directorate to review the project related cost data, schedule status and performance progress.

DOE Review – Occasional Site visits will be arranged between the Project Manager and DOE Project Director

PMG—Status will be reported monthly to Fermilab Division Heads and the DOE at Project Management Group meetings.

POG—Status will be reported monthly to the Fermilab Directorate Project Oversight Group meetings.