

Muon Delivery Ring

Project Plan
September 2013



Fermi National Accelerator Laboratory

A Department of Energy National Laboratory
Managed by Fermi Research Alliance, LLC



The Project Plan (PP) 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 PP 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 PP (e.g., name changes to the positions cited in the PP), 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.

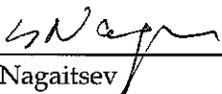
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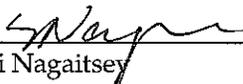
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A. Submittal Page

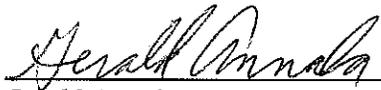
Submitted, Accepted, and Approved by:

 02/11/15
 Sergei Nagaitsev Date
 Chief Accelerator Officer
 Fermilab Directorate

 02/11/15
 Sergei Nagaitsev Date
 Accelerator Division Head

 2/10/15
 Mary Convery Date
 Muon Campus Program Coordinator

 2/10/15
 Gerald Annala Date
 Project Director

 2/10/15
 Gerald Annala Date
 Project Manager



B. Project Objectives

The Fermilab Antiproton Source was used for the production and accumulation of antiprotons required for the Tevatron Collider Program. With the end of that program, the Antiproton Source has become available to be used to support future muon experiments. Two experiments are already being planned with the possibility of more proposals at a later time. Modifications to the present Antiproton Source are required to convert the facility to support these muon experiments. The Muon Delivery Ring upgrade project is a \$9.2M effort designed to provide both 8.9 GeV/c protons and lower energy muons with the time structure required for the proposed muon experiments.



C. Project Scope

Improvements will be made to the Delivery Ring to allow an improved throughput of protons or muons for the future experiments. Injection devices and their power supplies will be built and installed that allow for the increased pulse rate. A required abort system including a kicker, septum, dump and beam line modifications will be included. Collider equipment that is no longer used will be removed to increase the aperture and make room for equipment required for the muon program. There will be infrastructure modifications required for the AC power distribution to the new circuits, as well a cooling to the new magnets. The AP30 refrigerator room will also be emptied and have its interior walls removed to make space for new equipment. Instrumentation will be improved to be compatible with the bunch structure, repetition rate, and intensities required by the future muon program.



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 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 PP 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 PP
- 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 Orders 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. Fermilab's Chief Accelerator Officer, and Accelerator Division Head, Sergei Nagaitsev, is the



Project Sponsors championing the project. The Project Sponsor establishes and approves the mission need and allocates the funds from the Fermilab budget.

Procurement, installation, cost and schedule for this project are the responsibility of the Accelerator Division (AD) which 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 Gerald Annala 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 Gerald Annala of the Accelerator Division's Muon Department as Project Manager. James Morgan has been designated as the Deputy 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.

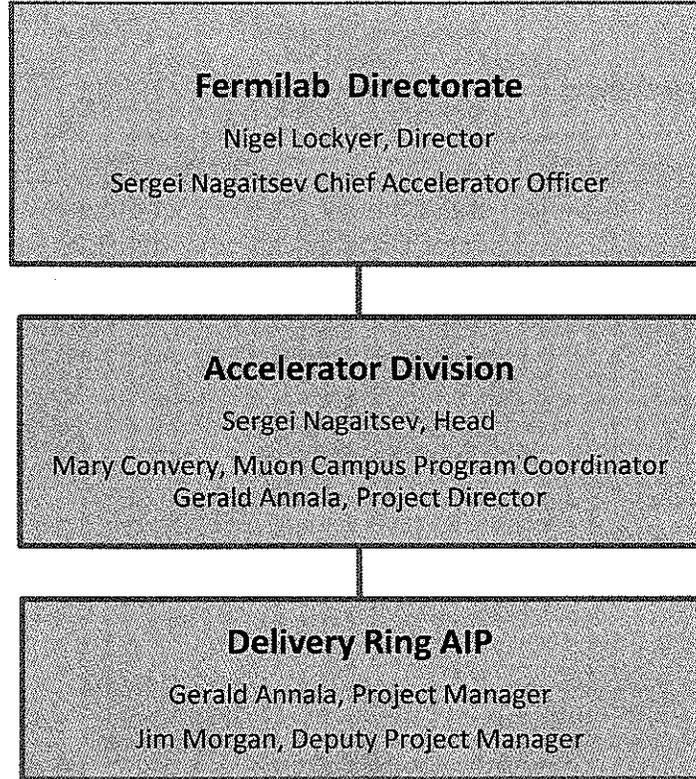
ES&H Management

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.

The Muon Campus project has been found to comply within the Fermilab generic 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 Estimated Cost (TEC) of \$9,213,644.

Personnel

- A. 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 Beam Transport and Delivery Ring 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
DR1.1	Project Management
DR1.2	Collider Equipment Removal
DR1.3	Electrical Infrastructure Improvements
DR1.4	Controls
DR1.5	Instrumentation
DR1.6	Power Supplies
DR1.7	Magnets
DR1.8	Tunnel 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. 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	Item Description	Base Cost w/Escalation	Contingency	Indirect Costs	TPC
DR1	Delivery Ring AIP	\$4,875,182	\$2,125,917	\$2,212,546	\$7,087,728
DR1.01	Delivery Ring Project Management	\$335,558	NA*	\$241,298	\$576,856
DR1.02	Collider Equipment Removal & Configuration	\$208,883	NA*	\$131,444	\$340,327
DR1.03	Delivery Ring Electrical Infrastructure	\$371,795	NA*	\$124,977	\$496,772
DR1.04	Delivery Ring Controls	\$287,291	NA*	\$110,758	\$398,049
DR1.05	Delivery Ring Instrumentation	\$110,053	NA*	\$82,291	\$192,344
DR1.06	Delivery Ring Power Supplies	\$2,296,336	NA*	\$1,048,795	\$3,345,131
DR1.07	Delivery Ring Magnets	\$598,879	NA*	\$168,634	\$767,513
DR1.08	Delivery Ring Installation	\$666,387	NA*	\$304,349	\$970,736
* Not maintained at this level					



Escalation

The baseline estimates have been escalated by task within Microsoft Project using the following escalation rates:

M&S= 2.7% /year (FY14, FY15, FY16, FY17)

SWF= 2.7% /year (FY14, FY15, FY16, FY17)

The rates utilized for Materials and Service (M&S) are as suggested by the most recent OEM 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. Should I update month # if in the past

MILESTONE	DEFINITION	BASELINE
Start Project	Directive signed	Month 0
Begin disassembly of Accumulator	Studies using Antiproton Source configuration complete	Month 7
Controls links to ring buildings established	Ring controls operating via new controls duct to AP30	Month 8
Collider equipment removal complete	Obsolete collider equipment removed from tunnel and service buildings	Month 14
Electrical infrastructure upgrades complete	AP30 and AP50 building power distribution upgrades installed	Month 33
Magnet construction complete	Magnets built or refurbished by Technical Division delivered for installation	Month 34
Installation complete	Installation of all equipment necessary to run g-2 is installed.	Month 35
Project Complete	Project Closed	Month 38



Delivery Ring Upgrade
Project Plan

Obligation Profile

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

	FY13	FY14	FY15	FY16	FY17	Total
Labor						
SWF Base Escalated	\$18,762	\$393,892	\$329,605	\$837,763	\$65,211	\$1,645,233
SWF Indirect Costs	\$17,527	\$366,799	\$317,558	\$715,366	\$55,684	\$1,472,933
Subtotal	\$36,288	\$760,691	\$647,163	\$1,553,129	\$120,895	\$3,118,166
SWF Contingency	NA*	NA*	NA*	NA*	NA*	NA*
Total	\$36,288	\$760,691	\$647,163	\$1,553,129	\$120,895	\$3,118,166
M&S						
M&S Base Escalated	\$2,633	\$525,738	\$1,251,107	\$1,424,176	\$26,295	\$3,229,949
M&S Indirect Costs	\$518	\$103,413	\$294,385	\$335,109	\$6,187	\$739,612
Subtotal	\$3,151	\$629,151	\$1,545,492	\$1,759,285	\$32,482	\$3,969,561
M&S Contingency	NA*	NA*	NA*	NA*	NA*	NA*
Total	\$3,151	\$629,151	\$1,545,492	\$1,759,285	\$32,482	\$3,969,561
Total						
Base Escalated	\$21,395	\$919,630	\$1,580,712	\$2,261,939	\$91,506	\$4,875,182
Indirect Costs	\$18,045	\$470,212	\$611,943	\$1,050,474	\$61,871	\$2,212,545
Subtotal	\$39,439	\$1,389,842	\$2,192,655	\$3,312,413	\$153,377	\$7,087,727
Contingency	NA*	NA*	NA*	NA*	NA*	\$2,125,917
Total	\$39,439	\$1,389,842	\$2,192,655	\$3,312,413	\$153,377	\$9,213,644
* Not maintained at this level						



Change	Approval Required	Change Request Form
In scope \leq \$100k or \leq 3 months schedule change	Project Manager	Required
In scope $>$ \$100k or $>$ 3 months schedule change	Control Board	Required
Total Project Cost	Control Board DOE Fermi Site Office Fermilab Directorate	Required
Non-Emergency required for ES&H regulations	Control Board	Required
Change to Project Scope	Control Board DOE 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. Nagaitsev
Fermilab AD	S. Nagaitsev
Program Manager	M. Convery
Project Director	G. Annala
Project Manager, Chair	G. Annala

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 Review

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, 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.