

Beam Transport

Project Plan
February 2015



Fermi National Accelerator Laboratory

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



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



Beam Transport
Project Plan

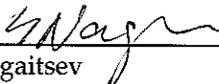
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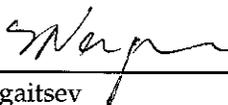


A. Submittal Page

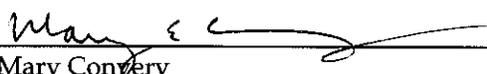
Submitted, Accepted, and Approved by:

 02/11/15
Sergei Nagaitsev Date

Chief Accelerator Officer
Fermilab Directorate

 02/11/15
Sergei Nagaitsev Date

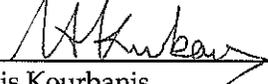
Accelerator Division Head

 2/10/15
Mary Convery Date

Muon Campus Program Coordinator

 2/10/15
Gerry Annala Date

Project Director

 2/10/2015
Ioanis Kourbanis Date

Project Manager



B. Project Objectives

In order to provide beam to the Muon Campus, the beam will be extracted from the Recycler Ring, injected into the P1 line, and transported through the P2 and M1 lines. The Beam Transport project is a \$6.51M effort that is designed to provide the extraction system from the Recycler, the beamline connection from the Recycler to the P1 line, aperture improvements needed to transport the 8-GeV proton beam efficiently in the P1, P2 and M1 beamlines, as well as other instrumentation and infrastructure upgrades in those beamlines.



C. Project Scope

The Beam Transport project will provide an extraction system (Lambertson and kicker magnets) from the Recycler, the beamline connection from the Recycler to the P1 line, aperture improvements needed to transport the 8 GeV proton beam efficiently in the P1, P2 and M1 beamlines, as well as instrumentation, controls and electrical infrastructure upgrades in those beamlines.



C. 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:

- 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.

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

As with all activities at Fermilab, the Directorate is at the highest level of responsibility. The Fermilab's Chief Accelerator Officer, and the Accelerator Division Head, Sergei Nagaitsev, is the Project Sponsor championing the project. The Project Sponsors establish and approve the mission need and allocate the funds from the Fermilab budget.

The Project Sponsors have designated Mary Convery of the Accelerator Division as the Muon Campus Program Coordinator (Program Coordinator) and Jerry 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 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.

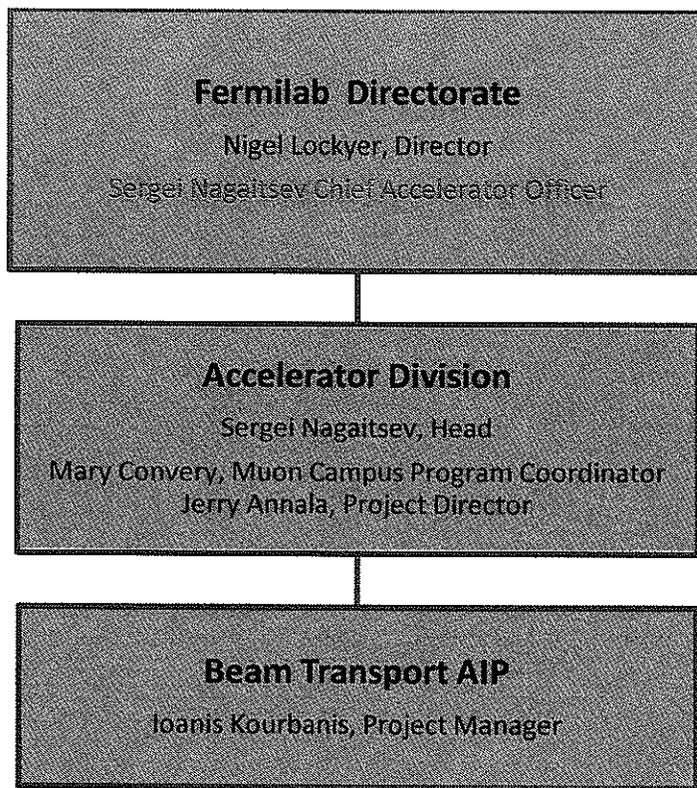
All project stakeholders are considered to be organizational project assets and are considered invaluable during the planning and execution of the project. The Program Coordinator and Project Manager will identify those key stakeholders and obtain the relative inputs critical to the project's success.

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.

The project is included in the Fermilab Muon Campus Categorical Exclusion (CX) approved by DOE on June 8, 2012.





E. Resource Requirements

Funding

This project is an Accelerator Improvement Project (AIP) with a Total Project Cost (TPC) of \$6,511,684.

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

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
BT1	Beam Transport AIP
BT1.01	Beam Transport Project Management
BT1.02	Beam Transport Extraction System
BT1.03	Beam Transport RR to P1 Beamline Connection
BT1.04	Beam Transport to Delivery Ring

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 with Escalation	Contingency	Indirect Costs	Total
BT1	Beam Transport AIP	\$3,548,961	\$1,273,073	\$1,689,650	\$6,511,684
BT1.01	Beam Transport Project Management	\$206,038	NA*	\$146,328	\$352,365
BT1.02	Beam Transport Extraction System	\$1,466,457	NA*	\$687,853	\$2,154,310
BT1.03	Beam Transport RR to P1 Beamline Connection	\$856,168	NA*	\$294,125	\$1,150,293
BT1.04	Beam Transport to Delivery Ring	\$1,020,298	NA*	\$561,344	\$1,581,642

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, FY16)

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
Beam Transport Extraction Kickers Complete		Month 10
Beam Transport RR to P1 Magnets Complete		Month 10
F27 Electrical Infrastructure Ready for Power Supplies		Month 17
Beam Transport Electrical Infrastructure Complete		Month 17
Beam Line Instrumentation and Controls Complete		Month 22
Beam Line Magnets Complete		Month 24
Beam Transport RR to P1 Installation Complete		Month 24
Beam Line Installation Complete		Month 25
Beam Line Power Supplies complete		Month 28
Project Complete	Project Closed	Month 31



Obligation Profile

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

	FY13	FY14	FY15	FY16	Total
Labor					
SWF Base Escalated	\$35,051	\$556,326	\$617,028	\$68,134	\$1,276,539
SWF Indirect Costs	\$32,965	\$496,393	\$579,734	\$58,180	\$1,167,272
Subtotal	\$68,016	\$1,052,719	\$1,196,762	\$126,314	\$2,443,811
SWF Contingency	NA*	NA*	NA*	NA*	NA*
Total	\$68,016	\$1,052,719	\$1,196,762	\$126,314	\$2,443,811
M&S					
M&S Base Escalated	\$106,000	\$682,113	\$1,330,302	\$154,007	\$2,272,422
M&S Indirect Costs	\$0	\$155,022	\$331,118	\$36,238	\$522,378
Subtotal	\$106,000	\$837,135	\$1,661,420	\$190,245	\$2,794,800
M&S Contingency	NA*	NA*	NA*	NA*	NA*
Total	\$106,000	\$837,135	\$1,661,420	\$190,245	\$2,794,800
Total					
Base Escalated	\$141,051	\$1,238,439	\$1,947,330	\$222,141	\$3,548,961
Indirect Costs	\$32,965	\$651,415	\$910,852	\$94,418	\$1,689,650
Subtotal	\$174,016	\$1,889,854	\$2,858,182	\$316,559	\$5,238,611
Contingency	NA*	NA*	NA*	NA*	\$1,273,073
Total	\$174,016	\$1,889,854	\$2,858,182	\$316,559	\$6,511,684



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

Conceptual 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 funds.

The Obligation Profile, depicted in Section F, closely matches the current DOE funding profile. This plan reflects the best estimate of funding levels and the baseline schedule. The Obligation 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 through 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 \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 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. Henderson
Fermilab AD	R. Dixon
Program Coordinator	M. Convery
Project Director	J. Annala
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.