



Department of Energy  
Office of Science  
Washington, DC 20585

MAR 15 2011

Dr. Pier Oddone  
Director  
Fermi National Accelerator Laboratory  
P.O. Box 500  
Batavia, Illinois 60510-0500

Dear Dr. Oddone:

Attached please find a signed copy of the Muon Accelerator Program Management Plan that has been submitted to the Office of High Energy Physics for approval. With this letter, I am formally approving the MAP program and its organization structure. As you know, starting in Fiscal Year 2011, OHEP has activated a separate B&R code (KA-15-02-03) for research conducted under this program.

I am looking forward to hearing new and exciting research results from this important program.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael Procaro", with a long horizontal line extending to the right.

Michael Procaro  
Acting Associate Director of Science  
for High Energy Physics

Attachment

cc: Stuart Henderson, Associate Director for Accelerator, Fermilab  
Steve Geer, Co-Director for MAP, Fermilab  
Michael Zisman, Co-Director for MAP, LBNL

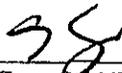


# Muon Accelerator Program

## Management Plan

December 14, 2010

Approvals:

  
\_\_\_\_\_  
S. Geer, MAP Interim Co-Director

*Michael S. Zisman*  
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M. Zisman, MAP Interim Co-Director

  
\_\_\_\_\_  
P. Oddone, Fermilab

  
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M. Procaro, DOE MAP Program Manager

  
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~~XXXXX~~, DOE-OHEP  
M. Procaro

## ***Introduction***

This document describes the organization being set up in response to a request the Fermilab Director has received from DOE/OHEP asking that Fermilab serve as the host laboratory for an integrated national muon R&D program. The goal of this organization (referred to hereinafter as the Muon Accelerator Program, MAP) is to execute a multi-year program aimed at completing a Muon Collider Design Feasibility Study, participating in the ongoing International Design Study for a Neutrino Factory, and providing a supporting muon accelerator technology R&D program. The MAP member institutions will collaboratively carry out these tasks as part of the Muon Accelerator Program. The MAP Program Director is responsible for all management, funding, and policy decisions within MAP, with technical advice from the Technical Board and policy advice from the Institutional Board. The organization set up to carry out the R&D program is described in the next section.

If needed, the Fermilab Director will take responsibility for initiating a revision to this Management Plan.

## ***Muon Accelerator Program Organization***

The aim of MAP is to carry out a multi-year R&D program aimed at developing the technology and simulation tools for intense muon beam scientific facilities—a Muon Collider and/or a Neutrino Factory. To do so, we have created an organization that delivers:

- a coherent, national R&D program
- a multi-laboratory and multi-university program
- a streamlined organization with clear reporting lines

## ***Organizing Principles***

The organizing principles of MAP (see Fig. 1) established by the Fermilab Director are listed below:

- Fermilab will provide overall leadership of the national Muon Accelerator Program (MAP).
- The MAP will be a multi-institutional effort, integrating participants from the existing NFMCC and MCTF.
- Existing commitments of NFMCC, such as to the Muon Ionization Cooling Experiment (MICE) and the International Design Study for a Neutrino Factory (IDS-NF), will be supported.
- The MAP organization will maintain the U.S. portion of the MICE organization in its current form.
- The MAP will have a dedicated management team, led by a Program Director appointed by, and reporting to, the Fermilab Director. The Program Director provides the primary point of management contact to DOE/OHEP.
- The Program Director will control the allocation of MAP funds to the participating institutions.

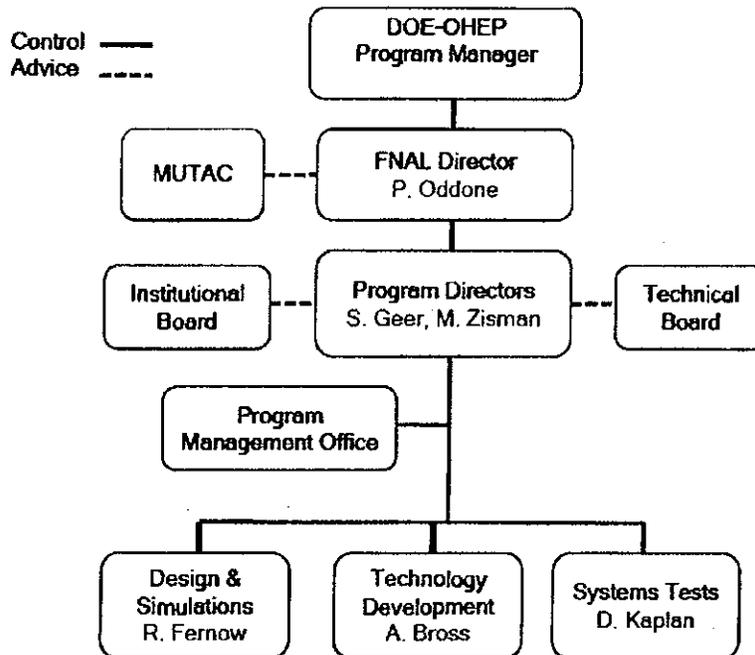


Fig. 1. MAP upper-level organization. The names indicated for Level 0 and Level 1 leaders are interim appointments. Initial members of the Institutional Board will also be interim appointments.

- DOE-OHEP will establish a Muon Program Manager who will oversee the MAP program from within the agency.
- The MAP will be organized and managed utilizing project management tools appropriate to an R&D program of this scale.
- Activities undertaken by the MAP and the associated resource support will be agreed upon with DOE, with a mutually understood ~7-year time horizon for development of the MC-DFS, the NF-RDR (under the auspices of the IDS-NF), MICE, and carrying out a supporting technology development program.
- An advisory committee (MUTAC) will monitor technical progress of the program and report to the Fermilab Director.
- The organization will provide a mechanism for interacting with international organizations that have common interests, such as the IDS-NF and the MICE collaboration.

### Proposed organization

- The Fermilab Director has appointed the MAP Program interim Co-Directors, and will later appoint the Program Director. The Program Director duties are described below in the section on Organizational Responsibilities.
- A Muon Technical Advisory Committee (MUTAC) will be appointed by the Fermilab Director as the primary body for technical advice and for review of the MAP activities.

- Distribution of funds to the participating institutions will be based upon the direction of the MAP Program Director.
- Various committees designated by the Program Director will aid in development of the technical strategy and coordination of the participating institutions. These are represented by the Technical Board and the Institutional Board in Fig. 1. The detailed structure and accompanying responsibilities and authorities will be defined by the Program Director, subject to some guidance from the Fermilab Director. Initial responsibilities are described in the section on Organizational Responsibilities.
- It is assumed that university groups will participate in the MAP. They will participate in planning and coordination via membership on the Institutional Board.
- It is assumed that a complementary Muon Collider Physics and Detector Collaboration will be formed, supported by a separate funding stream from the DOE. In order to provide close coordination between this Collaboration and the MAP, a Machine-Detector Interface task has been created within the MAP to serve as the primary technical contact point between the two organizations.
- The Level-2 structure for the MAP organization is shown in Fig. 2. The details of this organization have been determined jointly by the interim Program Co-Directors and the Level-1 managers.

## **Organizational Responsibilities**

### **Program Director Responsibilities (Level 0)**

The MAP Director is appointed<sup>1,2</sup> by the Fermilab Director and is responsible for directing the MAP program, that is, the MAP Director is responsible for all technical, policy and funding decisions within MAP, and will control the allocation of MAP funds to the member institutions. The MAP Director is also charged with:

- Updating, as necessary, and maintaining a multi-year plan for MAP activities including:
  - Definition of major goals and objectives: technical, cost, and schedule;<sup>3</sup>
  - Identification of required resources;
  - Definition of responsibilities within the program.
- Establishing and leading an organization to execute the MAP program.
- Defining and executing the supporting R&D program, including making final decisions on which technologies to pursue, i.e., ensuring timely “down-selection” of technical alternatives.

<sup>1</sup> The MAP Director does not have a fixed term, but serves at the pleasure of the Fermilab Director.

<sup>2</sup> It is anticipated that the Fermilab Director will designate a search committee to give advice on possible candidates for the MAP Director.

<sup>3</sup> Input to this plan will come primarily via the MAP Technical Board, and will be discussed with MUTAC.

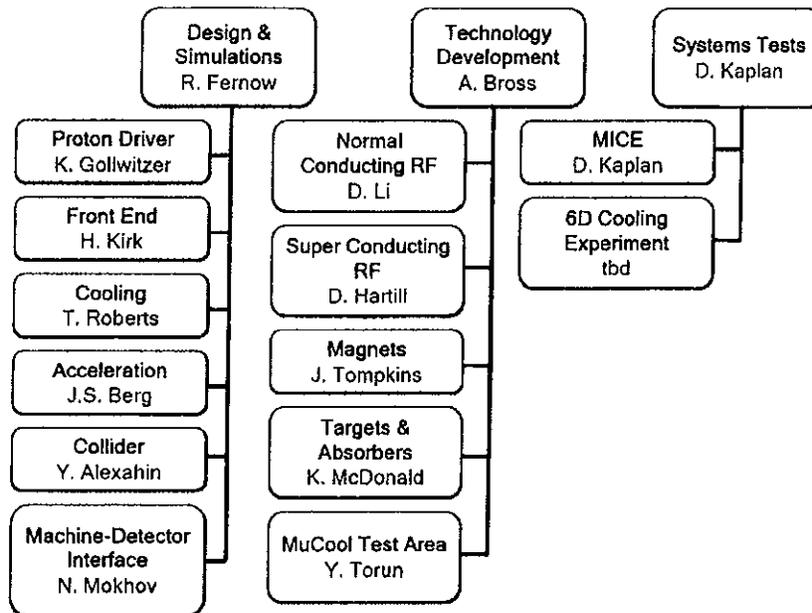


Fig. 2. Interim MAP Level-2 organization. Names indicated for Level 1 and Level 2 leaders are interim appointments.

- Providing periodic technical, cost, and schedule reports at a frequency agreed to with the Fermilab Director and DOE-OHEP.

### Level 1 Responsibilities

#### Design and Simulations

- Coordinate the design and simulation tasks for MAP, in particular those needed to produce the Muon Collider Design Feasibility Study (DFS) report and to provide the U.S. inputs for the IDS-NF Reference Design Report (RDR), including any site-specific considerations that may arise. Ensure that machine-detector interface issues are given proper consideration and are tightly coordinated with the parallel Muon Collider Physics and Detector Study.
- Provide simulation support needed for planning the 6D cooling section component bench test.
- Develop a Level 2 organization to accomplish these tasks and identify (with concurrence of the Program Director) Level 2 managers for each activity. To the extent practical, this organization should reflect the population of MAP, including national laboratories, universities, and SBIR companies.
- Develop and maintain a plan to execute all of the Level 2 tasks in the Design and Simulations technical area. The plan should include milestones and deliverables, and for each participating institution, effort levels and M&S needs.

- Manage the effort to accomplish the Level 2 tasks in the Design and Simulations technical area within agreed-upon budgetary and schedule guidelines.
- Participate in preparations for MAP reviews.
- In consultation with the Program Director, define and monitor the annual budget and effort level required to accomplish the proposed tasks.

### Technology Development

- Coordinate the technology development tasks for MAP, in particular those needed to demonstrate the feasibility and cost range of the components that form the technical basis of the Muon Collider and Neutrino Factory designs.
- Provide components required for the 6D cooling section component bench test.
- Develop a Level 2 organization to accomplish these tasks and identify (with concurrence of the Program Director) Level 2 managers for each activity. To the extent practical, this organization should reflect the population of MAP, including national laboratories, universities, and SBIR companies.
- Develop and maintain a plan to execute all of the Level 2 tasks in the Technology Development technical area. The plan should include milestones and deliverables, and for each participating institution, effort levels and M&S needs.
- Manage the effort to accomplish the Level 2 tasks in the Technology Development technical area within agreed-upon budgetary and schedule guidelines.
- Participate in preparations for MAP reviews.
- In consultation with the Program Director, define and monitor the annual budget and effort level required to accomplish the proposed tasks.

### System Tests

- Coordinate the system test tasks for MAP, in particular those needed to demonstrate the feasibility and cost range of the cooling systems that form the technical basis of the Muon Collider (a 6D cooling experiment) and Neutrino Factory (MICE) designs. For MICE, development of the experiment through Step 6 is assumed. For the future 6D cooling experiment task, prepare a plan (including specifications for the components to be tested) leading to an integrated bench test of a set of realistic 6D cooling channel components. This plan should include resources needed, definition of what tests will be performed, and metrics for what constitutes a successful test. In preparation for a subsequent full-fledged 6D cooling experiment, assess the need for, and if appropriate prepare a formal proposal for, a cooling test with beam.
- Develop a Level 2 organization to accomplish these tasks and identify (with concurrence of the Program Director) Level 2 managers for each activity. To the extent practical, this organization should reflect the population of MAP, including national laboratories, universities, and SBIR companies.
- Develop and maintain a plan to execute all of the Level 2 tasks in the Systems Tests technical area. The plan should include milestones and deliverables, and for each participating institution, effort levels and M&S needs.

- Manage the effort to accomplish the Level 2 tasks in the Systems Tests technical area within agreed-upon budgetary and schedule guidelines.
- Participate in preparations for MAP reviews.
- In consultation with the Program Director, define and monitor the annual budget and effort level required to accomplish the proposed tasks.

### **Institutional Board**

The Institutional Board (IB) is an advisory board to the MAP Program Director and, in this capacity, will represent the members of MAP.

1. The IB will consist of one representative from each participating institution, chosen by the institution as the appropriate representative for all matters of policy. Initial institutional membership will be derived from the membership of the NFMCC and MCTF. Membership in MAP will include, but is not restricted to, individuals or institutions receiving MAP funding.
2. The Chair of the IB will be chosen by the IB membership from among its members, in consultation with the Program Director.
3. The IB Chair will be responsible for:
  - a. organizing IB meetings and, in consultation with the Program Director, setting the meeting agendas;
  - b. organizing any required IB subcommittees (see item 9 below);
  - c. working closely with the Program Director to ensure that the tasks outlined in item 8 below are carried out in an effective and timely manner;
  - d. working closely with the Program Director to achieve consensus on policy issues.
4. The IB will appoint a secretary to take minutes of IB meetings. The secretary will also maintain the MAP membership list and directory, which will be available on the web, and an IB membership list, which will also be available on the web.
5. Based on input from the IB members, the secretary will also compile an annual list of publications of all work based on MAP support (including, in the interim period, work based on MCTF or NFMCC support). Insofar as possible, a list of muon R&D publications not directly supported by MAP funds should also be compiled.
6. The individual IB representatives will serve as the first point of contact between the Program Director and their respective institutions, and will be responsible for bringing to the attention of the Program Director any policy issues that affect their institutions.
7. The IB members will be individually responsible for negotiating with the Program Director the milestones and deliverables associated with any MAP funding their institution receives.
8. The IB will be responsible for:
  - a. defining guidelines for membership in the Muon Accelerator Program and advising the Program Director on changes to the membership;
  - b. setting MAP publication and presentation policies;

- c. bringing to the attention of the Program Director any policy issues that affect the general MAP membership;
  - d. advising the Program Director on ways to improve communication and outreach;
  - e. providing the IB secretary with publication information that enables the secretary to produce an annual MAP publication list.
9. At their discretion, the IB may appoint a subcommittee to be responsible for scheduling and organizing the MAP workshops and meetings requested by the Program Director.

### **Technical Board**

The Technical Board (TB) will assist the Program Director in assessing technical plans and budgets for carrying out the MAP R&D program. They will also review and assess any proposals from new institutions that might be submitted for MAP funding. Any recommended funding request, if approved by the Program Director, would be accommodated by means of reserve funds put aside at the beginning of each year.

1. The Technical Board (TB) is an advisory board to the Program Director, who will serve as its chair.
2. The existing NFMCC Technical Board (including the NFMCC Co-Spokespersons) will function as the initial TB during the period of transition. The TB comprises the Level 1 managers, together with other MAP members designated by the Program Director. TB meetings will be called and chaired by the MAP Program Director.
3. The TB will appoint a secretary to take minutes of TB meetings.
4. The TB will advise the Program Director on:
  - a. the support needed to accomplish MAP milestones;
  - b. the process to make choices between alternative technical options;
  - c. changes required to the MAP R&D plan in response to new results;
  - d. proposals from new institutions to carry out MAP-supported R&D.

### **Program Management Office**

The Program Management Office (PMO), based at Fermilab, provides support for the administrative and organizational tasks of the MAP Program Director. This support includes:

1. budget monitoring and planning;
2. web site development;
3. documents database development and maintenance.

The PMO will provide the means to collect and maintain financial summaries for MAP funds, including information from participating institutions using such funds. They will also collect information on progress toward milestones from all MAP institutions. The PMO will aid the MAP director as needed in the preparation of progress reports required by the Fermilab Director and/or DOE-OHEP.

MAP will be managed using project tools, with status reported to the MAP Director on a monthly basis. A Work Breakdown Structure (WBS) and Resource Loaded Schedule (RLS) will be established to manage MAP activities. Milestones within the RLS are the primary mechanism for understanding progress relative to the schedule. The WBS is the primary mechanism for identifying the scope of work associated with planned MAP activities. Cost accounting will provide feedback on whether resource utilization is proceeding as planned. The MAP Estimate at Completion (EAC) will be updated periodically and reported to the MAP Director. The MAP Director will periodically report technical progress, cost accounting status, and EAC status to the Fermilab Director.

### Advisory Groups and Peer Review

To evaluate its progress, the Fermilab Director has selected an international Technical Advisory Committee (MUTAC) to review MAP annually. Prof. David Rubin (Cornell) is the current MUTAC chairperson. Members (see Table 1) are rotated on a three-year cycle, with roughly one-third of the membership exchanged in any given year. MUTAC prepares a written report after each meeting that is sent to the Fermilab Director and the MAP Program Manager at DOE. The DOE OHEP Program Manager will also see to it that a MAP review is carried out annually.

Table 1. Current MUTAC membership.

Name	Institution
John Byrd	LBNL
David Finley	FNAL
Vladimir Litvinenko	BNL
Peter McIntosh	Daresbury Laboratory
Lia Merminga	TRIUMF
David Rubin (Chair)	Cornell
Michael Shaevitz	Columbia
tbd	SLAC
Thomas Roser	BNL
Susan Smith	Daresbury Laboratory
Mike Syphers	Fermilab
Frank Zimmermann	CERN