

To: G. Blair, for the MICE Funding Agency Committee
 From: S. Peggs, for the MICE Project Board

Date: November 19, 2013

Cc: MICE Project Board

Report from MICE Project Board Meeting 6 – November 14, 2013

The sixth meeting of the MICE Project Board (MPB) took place on November 14, at RAL. Present for the review were: Stu Henderson, Charlotte Jamieson (ex officio), Jim Kerby, Steve Peggs (chair), Ron Prwivo (ex officio), Ian Robson, Roger Ruber, Bruce Strauss (ex officio), Thomas Taylor and John Thomason (ex officio). The agenda for the meeting is included in Appendix A, and the charge to the committee in Appendix B.

The presentations made by MICE collaborators were of consistently high quality, and the discussions that ensued were stimulating, direct and useful. We thank the collaboration members who contributed to the meeting for all their hard work, careful thought, and hospitality.

Step #	Scheduled run date								
	2003 Jan/Aug	2006 Phase I prop.	2009	2010 Sept. MPB1	2011 June MPB2	2012 Mar. MPB3	2012 Oct. MPB4	2013 May MPB5	2013 Nov. MPB6
I	04		Running	→ 10					
II	05		10	11					
III	06		10 → 11	11					
IV	06		11	≥ 11	12	Q1 13	Q2 14	Q1 15	Q2 15
V	06		12-13	12-13	14	-	-	Q3 17	Q4 18
VI	07/08	10	≥ 13	≥ 13	15	16	18	19	20

Table 1. MICE schedule evolution, from the project proposal until the present.

INTRODUCTION

The MICE mission is to:

- Design, engineer and build a section [cell] of cooling channel capable of giving the desired performance for a Neutrino Factory;
- Place it in a muon beam and measure its performance in various modes of operation and beam conditions, thereby investigating the limits and practicality of cooling.

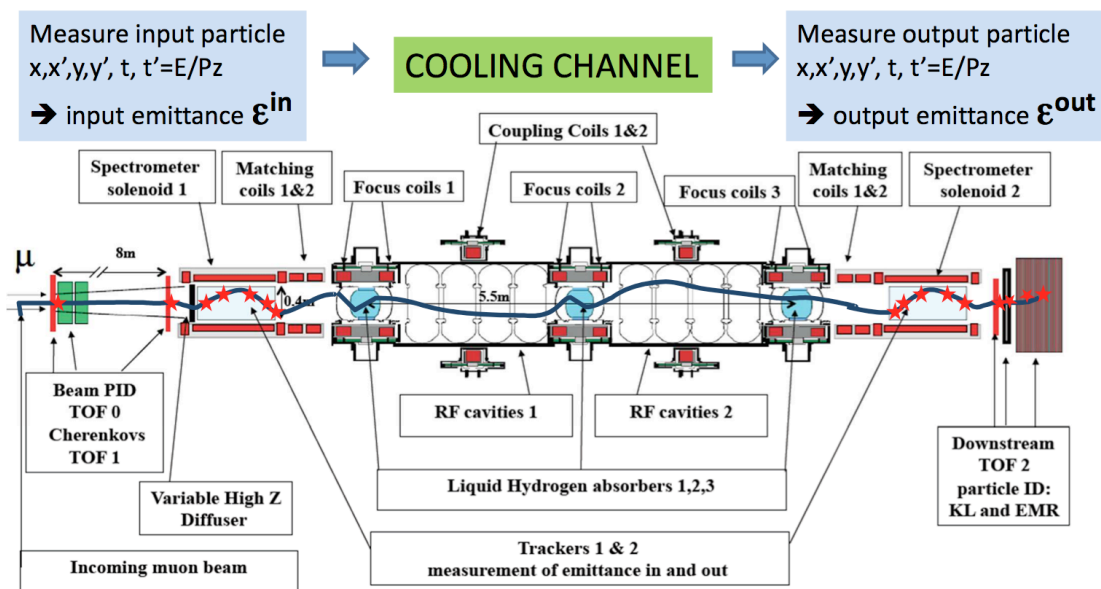
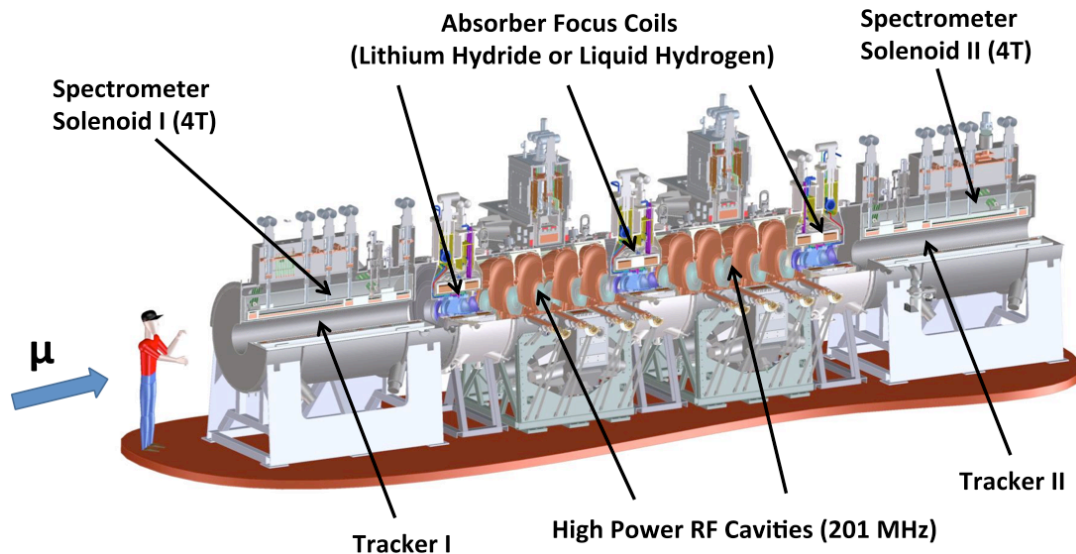


Figure 1. Perspective and schematic views of the complete MICE layout in Step VI.

OVERVIEW

The technical progress on the project has been very positive in the last six months, with the arrival of numerous items of equipment at RAL. These include the RF amplifier from Daresbury, 11 crates of RF materials from the University of Mississippi, the entire electron muon ranger (EMR) detection system from Geneva University, and the first of the spectrometer solenoids from the USA. Progress on other areas is also going well.

The “MICE Stray Field Mitigation Review” in September made a technical review of the magnetic shielding in the hall, providing a very positive result that is now being taken forward (see below). The solution is to use a partial return yoke (PRY), which will be installed around the magnets. The PRY is now under design. The construction and installation has been fed into the schedule with the result being that the completion of the Step IV installation has now been pushed back to the end of January 2015. This is still ahead of the next ISIS run.

On the other hand, the testing of the first focus coil module (FC1) was disappointing in that it barely achieved the minimum current required in flip mode, resulting in no margin whatsoever. This has potential implications for the science achievable and a critical decision point will arrive when the second focus coil is tested in the very near future. The project has produced a decision tree that covers the possible outcomes and ways forward.

Spectrometer Solenoid 2 (SS2) has arrived in at RAL, while the other solenoid, SS1, will start testing this year and is scheduled for arrival at RAL in May 2014. A second test of the coupling coil cold mass at Fermilab is also scheduled before the end of this year.

There have recently been a number of changes to key personnel. Professor Alain Blondel decided not to seek re-election as MICE Collaboration Spokesperson, and Professor Ken Long was elected unanimously to this role. This change also means that Professor Long will need to relinquish his role as UK-PI, and a search for a replacement is in progress.

Professor Blondel has been an inspirational leader of both the MICE experiment and also the construction project. It is fortunate indeed that Alain will remain involved in MICE, albeit not as spokesperson. The MPB would like to take this opportunity to unreservedly thank Alain for his leadership, commitment, inspiration and patience. The MICE experiment and project would not have gotten to this point without him.

The top-level management organisation for the construction project that was formed at the last meeting of the MPB – the MICE International Project Office (MIPO) – has undergone some changes over the summer. The International Project Manager is now Roy Preece. The new post of Project Engineer, manned by Andy Nichols, is effectively responsible for the UK host lab construction efforts. Another new (or redefined) post is that of MICE-UK Project Associate, occupied by Alan Grant, which is effectively a planning engineering post. Symmetric to this role in the organogram shown in Figure 2 is the MICE-US Construction Project Manager, Alan Bross.

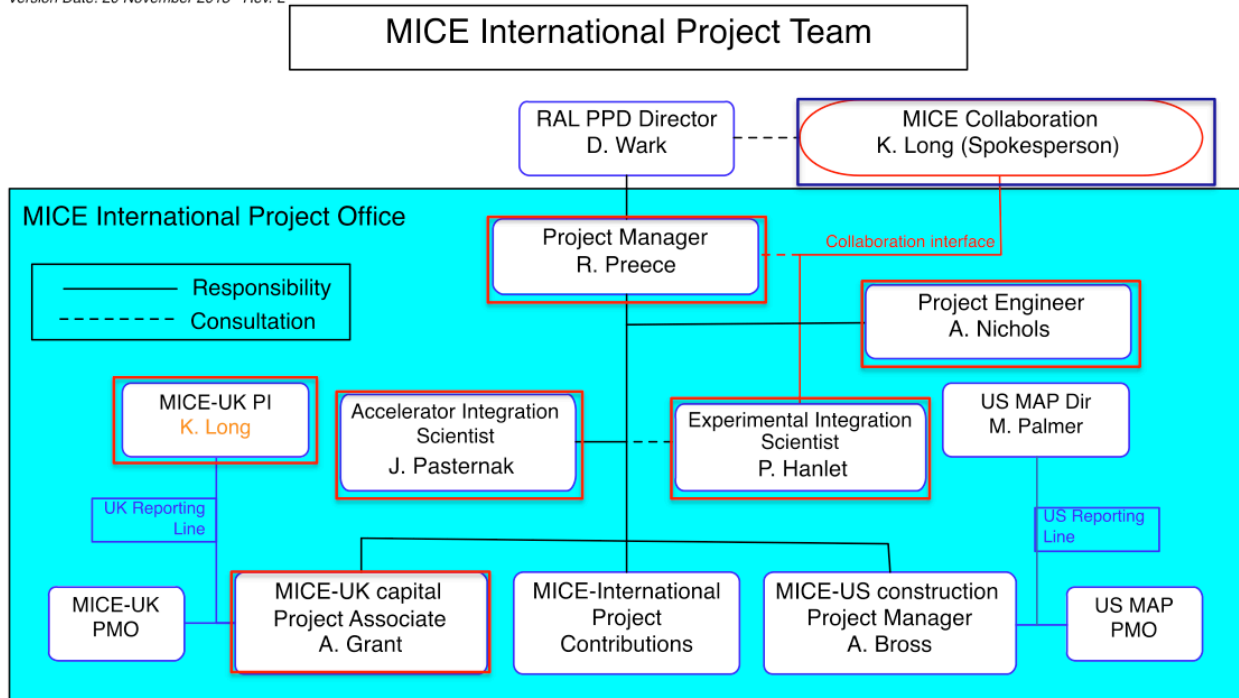


Figure 2. The MICE International Project Office (MIPO), November 2013.

A number of the previously vacant posts have now been filled, but there are still some vacancies. A good candidate is expected to be in the vacant and crucial post of Hall Manager by early December. This is an important recruitment.

As the project looks towards operations in Step IV and beyond, it has identified the need for another management tier, the Mice Experimental Management Office (MEMO). This is work in progress and is intended to provide overlap with the construction project. Two posts in the MEMO are currently vacant but work on recruitment to these is in hand. The Board felt that there was still some way to go in integrating the MIPO and MEMO sides of the project together and that this would be a challenge for the new Project Manager. The next set of meetings will be a test to see how progress has moved forwards.

John Thomason chairs a MICE-ISIS safety management committee that will continue to meet on a 3-monthly basis to cover all aspects of MICE safety. Safety working groups that report to the management committee will be formed to address specific safety issues, such as RF commissioning, following the successful model demonstrated by the liquid hydrogen working group. Andy Nichols, the Project Engineer, explicitly retains the responsibility for safety that was delegated to him from Dave Wark, Head of the Particle Physics Department.

There was a noticeable redundant overlap between the presentations made at the Resource Loaded Schedule Review (November 13) and at the MPB (November 14) meetings. The MICE project management will work with the chairs of these committees to more efficiently arrange the agenda, the next time that we meet.

SUPERCONDUCTING MAGNETS

Spectrometer solenoid magnets

The committee congratulates the MICE team on the arrival of the first SS in the UK! The team has grown and has been tenacious in determining the causes of previous failures. Continued high vigilance is required as the final acceptance tests are completed. The job will not be complete until the magnets are in successful operation.

Focusing coil modules

The first FC module FC1 appears to have a limitation in coil #1. MICE has made a sensible choice to move on with module FC2 tests before deciding what to do with module 1. Should FC2 be successful, MICE might exhaustively test FC1 in various modes, perhaps including one coil at a time, to gain every bit of information possible before disassembly, if that is the path chosen. Given the stick-slip effect, any new data could be very useful in confirming (if possible) the location of the problem, and how to fix it. While vague, the team said some of these sorts of tests had been contemplated. It would be good to write a test plan for FC1 (and FC2) that will maximize the information available before (for instance) a disassembly is begun, should it be needed.

Coupling coils

The CC test was limited by heat load and poor workmanship. A next test will be completed in a couple of months.

Stray magnetic field

Following the September MICE Stray Field Mitigation Review, MICE is proceeding with the final design of shielding to be installed before Step IV. The design as presented is advanced and appears reasonable. The MICE Project's reaction to this issue is commendable.

Recommendations

1. Document a set of modes for the magnets at each acceptance test and each Step (IV, V and VI) as installed such that a consistent set of conditions is used across all simulations, and present at next meeting
2. Clearly document the nominal operating point (or maximum operating point), and the design point for each coil, such that the magnet performance during a test is clearly compared to the target value. For instance, for the Coupling Coil, the desired current should not be quoted as “~200 A”. Present documentation at next meeting.
3. Document the acceptance criteria and establish the acceptance test plans for each coil, independent of whether the interface is a vendor or a collaborator, before testing begins. At minimum this will assist with the required tests completed before shipment.

4. Present quench training results of the Focus Coil 2, CC1 cold mass and SS1 to the Board as soon as the data become available.
5. Explore magnetic shielding solutions for Steps V and VI, together with implications for the general layout of the hall, and present findings at the next meeting.

RF SYSTEMS

Procurement and test of RF hardware is continuing. RAL has received a large shipment of components from the U.S. collaboration and the first amplifier station from the UK collaboration. Preparations for the first cavity test at the FNAL Muon Test Area (MTA) are ongoing, but are waiting for the power couplers to be completed.

LLRF system

The MICE collaboration is working on a LLRF design based on existing hardware from LBNL. This hardware has to be modified for the MICE frequency (200 MHz). The MTA test stand will use the existing LLRF from FNAL. An integrated test of LLRF and cavity is not feasible at the MTA due to existing limitations. The project team is discussing the implementation of a system test in the MICE Hall as part of the preparation of the RF system for Steps V and VI.

RF power station and RF distribution

The first RF power station has successfully operated at Daresbury Laboratory and is now installed at RAL in preparation for power testing before the end of this year. The RF distribution components required for this amplifier have been procured by Mississippi University and shipped to RAL.

RF Cavities

The first cavity is awaiting completion of the power couplers before testing can start at the FNAL MTA test stand. The conditioning and first test of the power couplers will be in-situ on the cavity.

Recommendations

1. Develop plans for an integrated RF system test at RAL – including RF power amplifier, prototype LLRF and a MICE cavity – and present at the next meeting.
2. Develop a plan to select the method for muon transit RF phase determination – perhaps using such an integrated RF system test – and present at the next meeting.

COMMISSIONING, CONTROLS & OPERATIONS

Good progress was evident in response to the several recommendations from the last MPB meeting associated with commissioning, controls and operations.

Controls Systems

Considerable thought has gone into the Controls and Monitoring activity for MICE. The architecture and framework of the controls system has been formulated. Systems, subsystems and those responsible have been identified.

The importance of integrated controls is fully recognized by the collaboration. Personnel have been appointed to coordinate this integration and to start developing an integrated control system. A documentation process has started to describe how this can be done in the form of a state machine solution. A MICE-wide EPICS Configuration DataBase (CDB) will be populated by the sub-system owners.

The use of the prototype control system for spectrometer solenoid operation and testing at the vendor has been a very positive development.

Commissioning the MICE hardware with the control system is a major activity and consequently needs adequate and realistic time allotted in the schedule.

Operations

The MICE Experiment Management Office has been formed. So far, this appears to be a positive step in terms of management of the experimental, scientific and operational aspects of MICE. An Operations team is being formed within MEMO, and some of the leaders responsible for RF, cryogenics, magnets and vacuum systems have been identified.

Constructive discussions are underway between MICE and ISIS Operations teams, regarding operational support for the MICE apparatus. This is a positive development. We encourage further engagement to establish and agree upon the full on-site support plan for day-to-day operation, maintenance and repair of the MICE hardware, incorporating ISIS operations support. The MPB endorses these discussions towards an efficient and effective collaboration between MICE and ISIS operations.

We share the collaboration's concern regarding the limited staff effort for the capabilities and efforts devoted to software, simulation and analysis tools.

Recommendations

1. Present a status report on the MICE simulation, online and offline analysis capabilities and show results of the end-to-end Monte Carlo simulations, including tracking and reconstruction, in support of the Step IV, V and VI physics goals at the next meeting.

2. Fully define the responsibilities and personnel for MICE operations and maintenance support, taking into account shared responsibilities with ISIS where appropriate and efficient, at the next meeting.

APPENDIX A – AGENDA

Thursday, 14 November 2013

- 09:00 - 09:30 Executive session (board only) 30'
- 09:30 - 09:50 **OPEN SESSION** Status of MICE experiment 20'
Speaker: Alain Blondel (Universite de Geneve (CH))
Material: **Slides**  
- 09:50 - 10:10 Status of MICE Project & dashboard 20'
Speaker: Roy Preece (STFC Rutherford Appleton Laboratory)
Material: **Slides**  
- 10:10 - 10:30 MICE Management summary 20'
Speaker: Prof. Kenneth Long (Imperial College London)
Material: **Slides**  
- 10:30 - 10:40 Coffee
- 10:40 - 11:05 MICE RF 25'
Speaker: Kevin Ronald (University of Strathclyde)
Material: **Slides**  
- 11:20 - 11:45 MICE controls and monitoring 25'
Speaker: Pierrick Hanlet
Material: **Slides** 
- 12:00 - 13:00 **WORKING LUNCH** – Board in executive session
- 13:00 - 13:25 Magnetic mitigation 25'
Speaker: Holger Witte (Brookhaven National Laboratory)
Material: **Slides**  
- 13:40 - 14:05 MICE Magnet Issues 25'
Speaker: Dr. John Cobb (Oxford University)
Material: **Slides**  
- 14:20 - 14:45 impact of magnet performance on the physics program of MICE 25'
Speaker: Dr. Chris Rogers (STFC)
Material: **Slides**  
- 15:30 - 15:45 Coffee
- 15:45 - 17:30 **CLOSED SESSION** 1h45'
- 17:30 - 18:00 Oral closeout - board and MICE management in closed session 30'

APPENDIX B – CHARGE TO THE COMMITTEE

October 22, 2013

MICE Review 6 - 13th & 14th November 2013

As with the review held in May 2013, this review will be split and covered by 2 separate panels, the Resource Loaded Schedule Review (RLSR) and the MICE Project Board (MPB), both of which report to Graeme Blair as Chair of the MICE Funding Agency Committee (FAC). Reporting takes the form of an initial presentation by the Chairs of the RLSR and MPB to the FAC meeting on 15th November, followed by a written document.

The focus for the RLSR will be the financial and human resources that are required to achieve the key milestones and for completion of the MICE program. The panel will want to consider the implications of a resource limited approach and fully understand the assumptions being made by the project and the experimental collaboration, as well as their assessment of the potential schedule delays.

The focus for the MPB will be progress towards the achievement of scientific and technical objectives of the project and the collaboration. They will consider the MICE analysis of the major active and future technical and the responses being made to mitigate them.

MICE project and experimental management will be asked to report on the recommendations and actions from the previous meetings, which are included in appendix 1. In doing so they should ensure that they cover the following major topics;

MICE Project Management

At the May 2013 Review of the MICE effort, the concept of the MICE International Project Office (MIPO) was presented and the first results of the MIPO efforts described. However, the issues associated with the interface and division of effort between the experimental collaboration and the MIPO was not fully described. Please provide a full description of the necessary relationships and decision paths.

MICE Magnet Fabrication and Integration Status for Step IV Experimental Operations

Describe the current fabrication, testing and integration status for the magnets required for Step IV running. Step IV operations require 2 spectrometer solenoids and 1 focus coil. In particular, summarize fabrication issues and the process used to deal with them, commissioning issues and the process used to deal with them, the performance characteristics of each of the magnets, and the status of beam line integration. Identify and discuss any issues that may impact Step IV operational readiness by the first half of 2015.

MICE Magnetic Mitigation Plan

Summarize the decision process for mitigation of high stray magnetic fields in the MICE Hall. In particular, summarize potential risks which remain for Step IV operational readiness by the first half of 2015.

MICE RF System

At the May 2013 Review of the MICE effort, a major focus was on the fabrication of the cooling channel magnets and installation/commissioning /operation plans for cooling channel for Step IV and for Step V/VI. It was noted that finalizing and testing a LLRF system and integrating it with the overall timing of the data acquisition system is an issue that needs near-term attention. In

addition, there exists a broader set of R&D, fabrication, integration and commissioning issues associated with the MICE RF system. Thus the MICE International Project Office is requested to present a summary of the RF system fabrication, integration and testing plan, along with a risk assessment identifying any potential R&D, personnel and funding issues.

MICE R&D Risks

Describe the principal R&D risks for each of Steps IV, V, and VI of the MICE program.

Summarize progress towards clearing these R&D risks as well as the anticipated schedule for clearing these risks taking into account likely budget constraints. Identify specific efforts that would have potential to shorten the MICE schedule if further funds were available in the near term.