MICE Project Assumptions Document

1 Scope

This document defines the project-level assumptions that have been made in the development of the plans for the construction, commissioning, operation and analysis of MICE in the Step IV configuration and in the final configuration in which ionization cooling will be demonstrated. Whereas there may be verbal agreements in place between individual institutes or funded countries, the Assumptions Document has been prepared by the MICE International Project Office (MIPO) and the MICE Experiment Management Office (MEMO) in consultation with the MICE Executive Board (EB). This document (Issue 1, draft 3) is presented to the Collaboration Board (CB) at its meeting on the 28^{th} October 2014 to solicit comments from the Board and to obtain its endorsement of the Assumptions Document. Upon endorsement by the CB the assumptions will be taken to have been agreed by the MICE collaboration.

This, the first version of the Assumptions Document, is centred around STEP IV. It will be finalised to include comments from the CB. Extensions to, and revisions of, the document will be considered periodically and the updated document will be re-issued once it has been endorsed by the CB.

2 Funding, institutes and international contributions

1. The STFC will continue to fund the MICE-UK construction and exploitation projects on a flat-cash basis to the completion of the demonstration of ionization cooling following the review of a proposal for continuation of the support to be submitted in UK financial year 2015/16;
2. The STFC will continue to provide grants to the Universities associated with the MICE-UK project at a level similar to that which is currently granted thereby enabling University personnel to participate in the advancement and completion of the project;
3. The DOE will fund the MICE-US project to the completion of the construction, commissioning and operation of Step IV and the ionization-cooling demonstration;
4. The MICE-US project team will deliver two RF cavities and the associated vacuum vessels, couplers and vacuum equipment as well as the US contributions to the Partial Return Yokes (PRYs) required at Step IV and for the cooling demonstration. In addition, the US will deliver two lithium-hydride absorber discs in accordance with experimental requirements to shield the trackers from dark-current-induced radiation. MICE US will take an active part in the commissioning and operation of the experiment at Step IV and in the demonstration of ionization cooling as well as playing an active part in the exploitation of the data from the experiment;
5. At both Step IV and in the cooling demonstration, MICE-UK will deliver, to the agreed schedule, the structures below floor level to support the PRY framework and shielding plates. All funding for these support structures will be borne by the MICE-UK project;
6. MICE-UK will provide the design, manufacturing and construction effort and the funding for the lithium-hydride absorber support structures and vessels;
7. At both Step IV and in the cooling demonstration, MICE-US will deliver, to the agreed schedule, the PRY and the necessary support structures above floor level. All funding for these items will be borne by the MICE-US project;

8. MICE-US will deliver, to the agreed schedule, two RF-cavity modules to a state of construction that will enable the MICE project to install the module in the MICE Hall. All funding required to construct the cavity modules will be borne by the MICE-US project no matter where the construction work is carried out;
9. MICE-UK will deliver the necessary infrastructure to operate the experiment including the RF-amplifier system required to power the cavities during the cooling demonstration. All funding for these items will be borne by the MICE-UK project;
10. The University of Geneva will remain fully responsible for the operation and support of the Electron Muon Ranger (EMR) detector system and the MICE DAQ system through to the completion of the MICE project. All spares and operational personnel will be funded through the University of Geneva;
11. INFN will remain fully responsible for the operation and support of the Time of Flight (TOF) and Kloe light (KL) detector systems through to the completion of the MICE project. All spares and operational personnel will be funded through the INFN;
12. MICE-US will continue to take responsibility for the support of the Cherenkov (CKOV) system through to the completion of the MICE project. All spares and operational personnel will be funded through MICE-US;
13. Responsibilities for the scintillating-fibre trackers is divided between the UK and US project teams. The UK has responsibility for all aspects of the mechanical structure of the tracker and the reconstruction and simulation software. The US has responsibility for the readout, DAQ and cryogenic systems;
14. The MICE-UK project will continue to take responsibility for the commission ion, installation, operation and maintenance of the following sub systems;
    (a) MICE infrastructure and construction-project management;
    (b) The hydrogen system and associated extraction and safety systems;
    (c) The focus-coil module and associated power supplies and cooling equipment; and
    (d) The MICE Muon Beam including the MICE target, the decay solenoid an the conventional magnets along with the associated power-supply, cooling and the storage equipment.
15. The MICE-US project will continue to take responsibility for the commissioning, installation, operation and maintenance of the following sub systems;
    (a) Spectrometer Solenoid magnets;
16. MICE-UK will assume responsibility for the components of the PRY supplied by the US on delivery to RAL.

3 Safety

1. The MICE Project Engineer will hold the full delegated responsibility for safety in all areas, activities and project periods through to completion of the MICE project holding the title of Group Leader In Matters Of Safety (GLIMOS);
2. All members of the MICE collaboration entering any MICE area will be required to have attended the Rutherford Appleton Laboratory site Safety Induction course and have been given the MICE induction by the GLIMOS before commencing work;
3. All members of the MICE collaboration will abide by STFC's safety regulations and codes of conduct.

4 Spares

1. **Control Room:**

(a) Networking systems will be provided by the Common Fund. One network switch will be held as a spare;

(b) Computing systems will be provided by the Common Fund. One computer and monitor will be held as a spare.

2. **Focus Coil Magnet system:**

(a) The power supply currently in the test rack in R9 will be the spare for operations during Step IV;

(b) An additional power supply will be supplied as spare by the MICE-UK project for the operation of the cooling demonstration;

(c) Lakeshore 218 thermal sensor monitors currently in the R9 rack will act as spares during Step IV operations;

(d) Two Lakeshore 218 thermal sensor monitor units will be supplied as spares by the MICE-UK for the operation of the cooling demonstration;

(e) AMI 135 LHe liquid level monitor - one unit will be provided by the MICE-UK as spare for the operation of Step IV and the cooling demonstration;

3. **Spectrometer Solenoid Magnet system:**

(a) A spare power supply for main and trim supplies will be provided by the MICE-US project;

(b) One Lakeshore 218 thermal sensor monitor units will be supplied as spares by the MICE-US for Step IV operations;

(c) AMI 135 LHe liquid level monitor - one unit will be provided by the MICE-US as spare for the operation of Step IV and the cooling demonstration;

4. **Cryomech compressor - 2 stage:**

(a) The MICE-UK project will provide one spare two stage compressor in the event of the failure of a compressor feeding the heads of the Focus Coil Magnet and Hydrogen system. The spare will provide backup to the other magnet systems in the channel in the event of failure;

(b) The MICE-US project will provide one spare two stage compressor in the event of the failure of a compressor feeding the heads of the Spectrometer Solenoid Magnet. The spare will provide backup to the other magnet systems in the channel in the event of failure.

5. **Cryomech 2-stage head:** *(Failure of a cooler head will result in the warm up and opening to air the cold mass of the Focus Coil or Spectrometer Solenoid magnets leading to a very large turn around time and cost)* :

(a) The MICE-UK project will provide one spare two stage cooler head in the event of a cooler head failure fitted in either the Focus Coil Magnet or Hydrogen system. The spare will provide backup to the other magnet systems in the channel in the event of failure;

(b) The MICE-US project will provide one spare two stage cooler head in the event of a cooler head failure fitted in the Spectrometer Solenoid Magnet. The spare will provide backup to the other magnet systems in the channel in the event of failure.

6. **Sumitomo compressor & cold head for the tracker cryostat:**
A spare compressor and cold head is available in the prototype cryostat. These will be serviced, the cost being shared between the UK and the US.

7. **Storage of spares:** will be provided by the MICE-UK either on or off site dependant of the size of equipment to be stored. Transportation to and from the storage area will be organised and carried out by MICE-UK.

5 Maintenance

1. Cryomech compressors require absorber changes after 20,000 hours of running. The absorber change can be carried out by MICE operational staff following the Cryomech guidelines for maintenance. The Project / Operation Manager will assign the task to a suitable person. The cost for replacement absorbers will be borne by the Common Fund;
2. Sumitomo compressors require absorber changes after 20,000 hours of running. The absorber change can be carried out by MICE operational staff following the Sumitomo guidelines for maintenance. The Project / Operation Manager will assign the task to a suitable person. The cost for replacement absorbers will be borne by the Common Fund;
3. Cryomech 2 stage cooler heads require maintenance after 20,000 hours of operation and must be returned to the Cryomech home factory in the US for maintenance:
   (a) MICE-UK will arrange all packing, shipping and documentation for all heads requiring maintenance;
   (b) The total cost of the packing, shipping and maintenance will charged to the Common Fund;
4. Vacuum system maintenance: the turbo units will need to be rebuilt periodically and the tip seals in the scroll pumps will require replacement. This will be a charge to the MICE Common Fund.

6 Gases

1. A common manifold for gasses (and compressed air) will be installed and will be funded from the MICE-UK project budget. The manifold will supply Nitrogen and Helium gases at a nominal pressure of 7.5 bar;
2. If a lower supply pressure is required the equipment to enable the step down will be provided and funded by the subsystem owner;
3. Gas used during experiment operational periods will be funded by the Common Fund at a pro rata rate according to the original purchase price. The pro rata cost of gases to be paid for by the Common Fund will be taken as payment for capital / resource items for the MICE-UK project. Administration for the gas usage and associated Common Fund charges will be carried out by the Hall manager;
4. Connection to the superconducting magnets for continued helium top-up will be included in the Common Fund gas usage and will be charged accordingly;
5. During installation and commissioning periods gas usage will be borne by the MICE-UK project budget.

7 Cryogens

1. Commissioning and training costs for liquid Helium will be borne by each super conducting magnet group;
2. Liquid Helium that will be used for the training and commissioning of the Spectrometer Solenoid and FC in the MICE Hall will be purchased through the MICE-UK project budget using the Common Fund as appropriate;
   (a) Invoicing to the US at the end of the commissioning / training period;
   (b) Through the purchase of equipment or services of the same value;
3. Liquid helium that will be used for the commissioning and cooling of the focus coil magnets will be borne by the MICE-UK project;
4. LHe usage during operations where a top-up of cryogens is required that will not be achieved by gas condensation will be borne by the Common Fund. Liquid helium will be purchased by the MICE-UK using the Common Fund as appropriate;

5. Each super conducting magnet group will provide expert knowledge and operators for all operations requiring use of cryogens. Cover will be provided through all commissioning and operational periods.

8 Vacuum

1. The MICE-UK project will provide a vacuum manifold system for all magnet and detector systems requiring vacuum;
2. The magnet and detector system owners will interact with the Vacuum package manager providing control and operation philosophy for their own system;
3. The Spectrometer Solenoid group will provide turbo molecular pumps, gauges, backing pumps and gate valves for each magnet;
4. MICE-UK will provide spares and operational support for all vacuum systems.

9 Construction

1. All lifting activities in the MICE Hall and R9 will be carried out by trained operators with clearance to operate cranes and hoists on the RAL site;
2. Each subsystem will provide staff to be on-site during installation activities for that subsystem to aid with that activity and to provide a conduit for decision making in the event of issues raised during installation work;
3. Method statements and risk assessments for the safe handling and installation of equipment will be provided to the MICE Project Engineer before work begins;
4. Risk assessments currently in existence for the equipment and any future amendments will be provided to the MICE Project Engineer before work begins.

10 Operational support staff

1. ISIS Cover–approximately 6 FTE will be funded for by the MICE-UK project budget with a fraction of the current Common Fund levy already set aside for project / operational support staff;
2. Detector System–each detector to supply expert operators during operational periods. The effort supplied will be sufficient to allow 24 hour running of the experiment;
3. Magnet System–each magnet system to supply expert operators during operational periods. The effort supplied will be sufficient to allow 24 hour running of the experiment.