Tutorial: Requirements for RoboCup MSL

(Robin Soetens, Bernardo Cunha, Jose Luis Azevedo, December 2015)

Good playing conditions are crucial for a well organized competition. Based on past experience we have created this document containing a list of required materials and general tips and tricks on how to build a MSL field that meets the rules of the competition and is robust enough to last for an entire tournament.

Questions can be directed to:
rc-msl-tc@lists.robocup.org (Technical Committee, TC)
rc-msl-oc@lists.robocup.org (Organizing Committee, OC)

Or to the Exec Committee:
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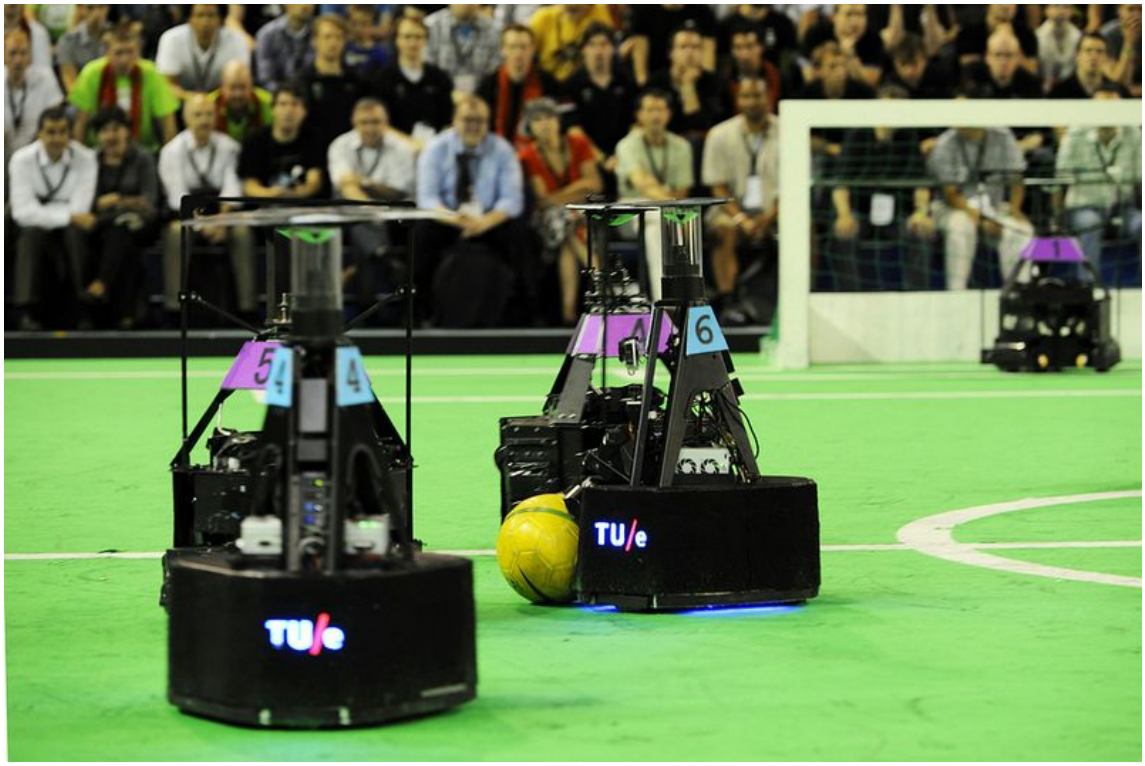
General info on the RoboCup MSL competition, along with the official rulebook, can be found on this wiki: http://wiki.robocup.org/wiki/Middle_Size_League

Table of Contents

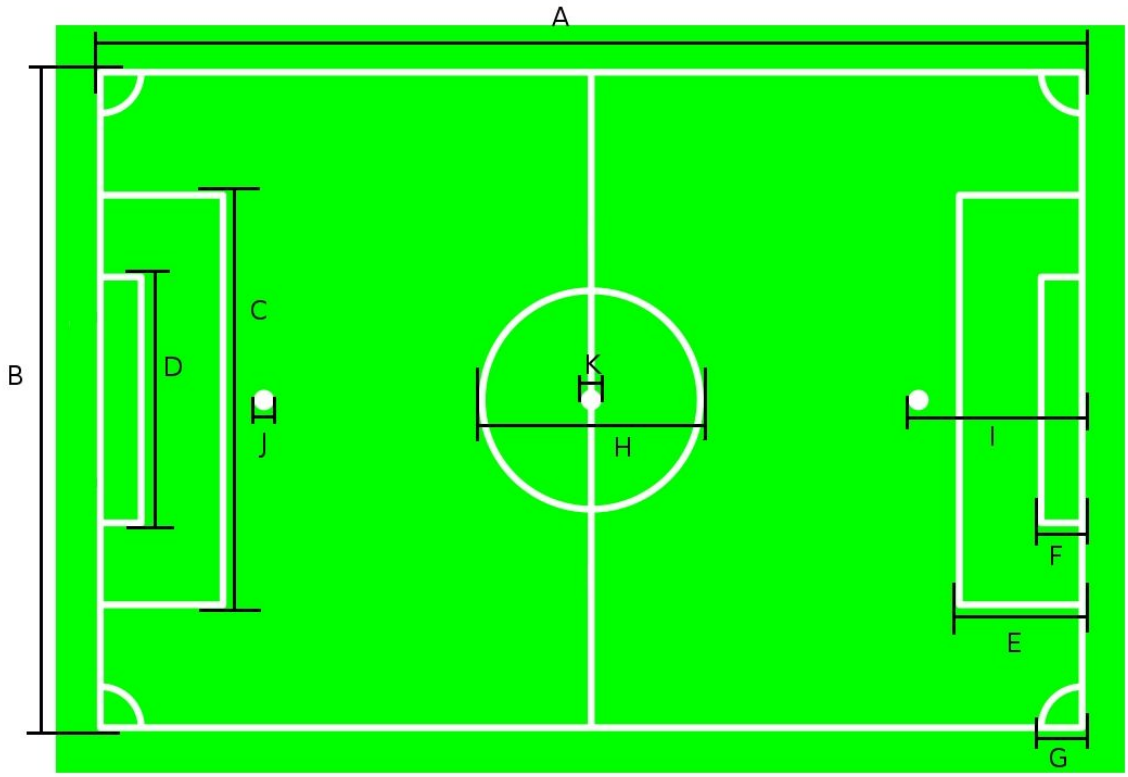


Playing Field Dimensions

Field dimensions are specified in the figure below. The width of each of the field lines is defined as 12.5 cm. Please note that the sketch is not scaled properly, it serves only to indicate which size goes where.

Although it probably is clear from the image: White lines are integral part of the field or of any of the areas they contain. Therefore, measurements are to be done from the outer side of any line. The only exception is the mid field line, which must divide the field in two equal-sized areas.

Between the outer lines of the field and the absolute edge of the field, **a green zone with a width of at least 1.5 meters should be present** (for safety and for the robots to manoeuvre behind the ball during throw-in and corner kick situations).



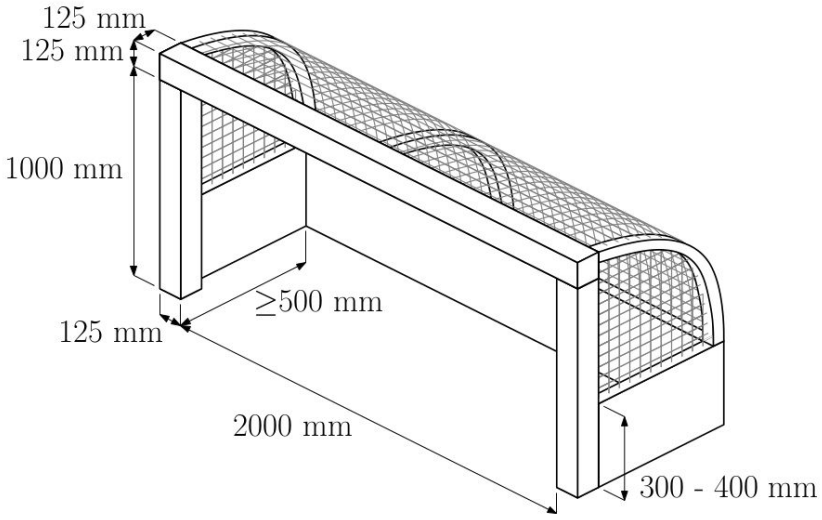
(Length of A,B,C… on next page)

A = 18 m	G = 0.75 m
B = 12 m	H = 4 m
C = ‘width of goal’ + 4.5 m	I = 3 m
D = ‘width of goal’ + 1.5 m	J = 0.1 m
E = 2.25 m	K = 0.15 m
F = 0.75 m	

Goal Dimensions

To avoid direct contact of the net with parts of the robots (wheels, kicking device, etc.), the lower part of the net should be covered over a height between 30 and 40 cm. The entire goal should be painted white.

The goal should be strong enough to handle collisions with robots weighing up to 40 kilograms and strong enough to handle shots with an official FIFA ball of up to ten meters per second. In case the goal is made out of a lightweight material, it should be fixed to the field surface. Please also note that goalkeeper robots should be able to move around within the goal without getting caught in the net.

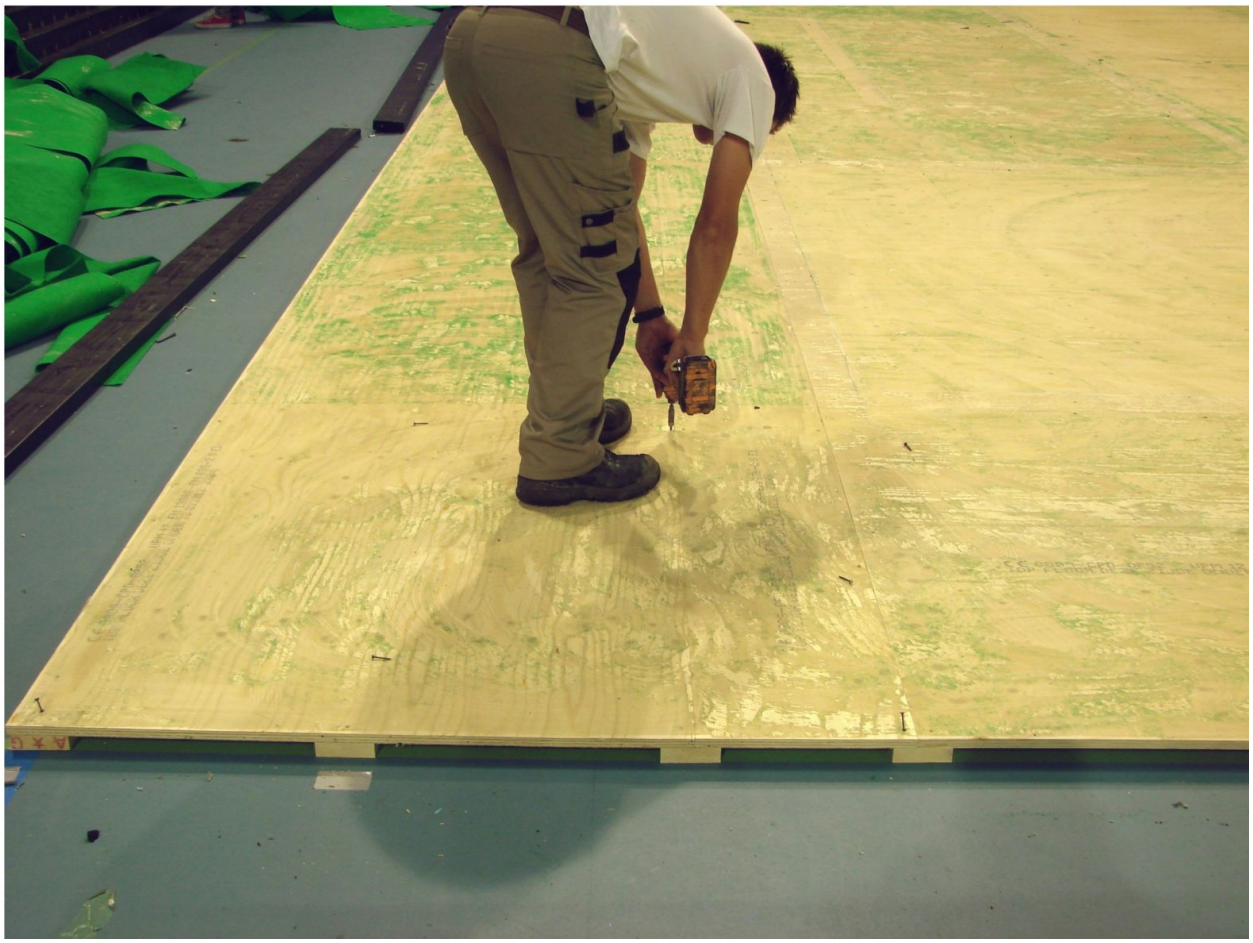


Constructing a Field

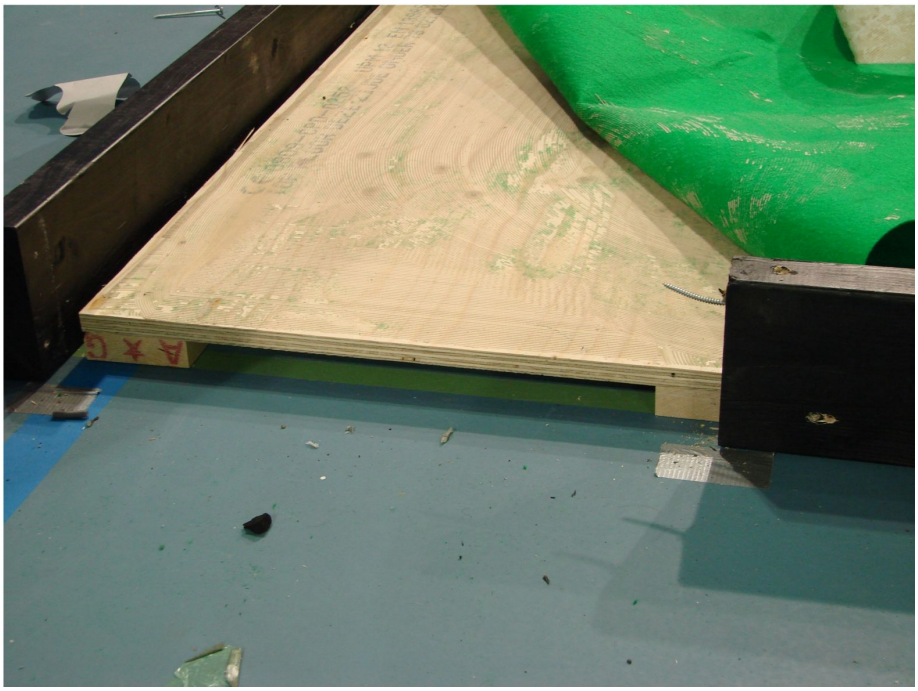
A RoboCup MSL field should be free of bumps and other surface irregularities. It should be covered by a thin green carpet glued to the subfloor. The carpet can be of a felt-like material but needs to be strong enough to stay intact when wheels of the robots are slipping for short periods of time.

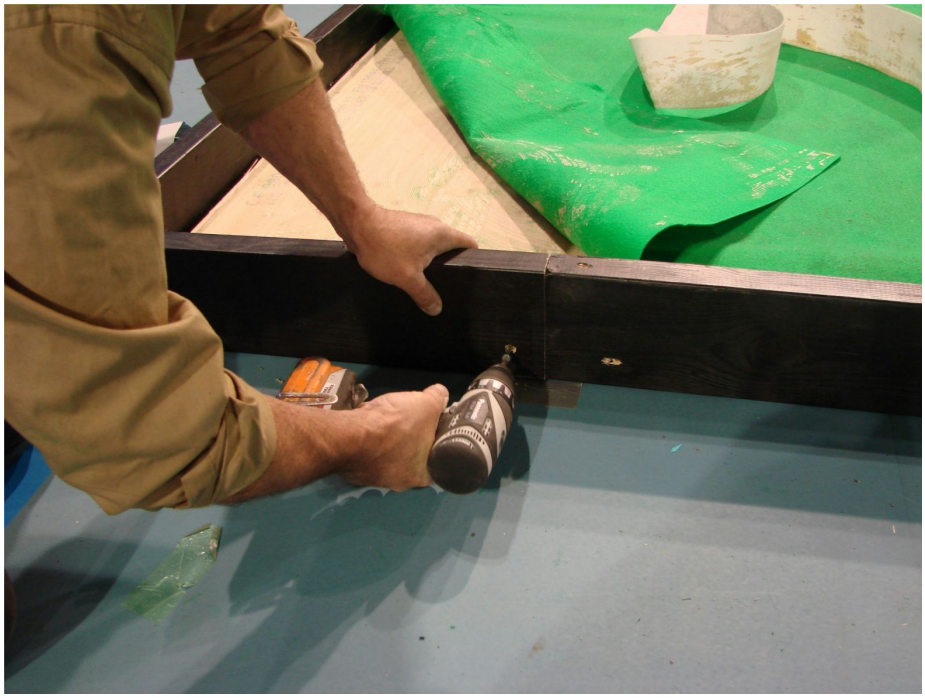
The following procedure is highly recommended:

1. Create a wooden subfloor, make sure no irregularities arise at the edges of the wooden plates and no screws or other sharp things are sticking out.

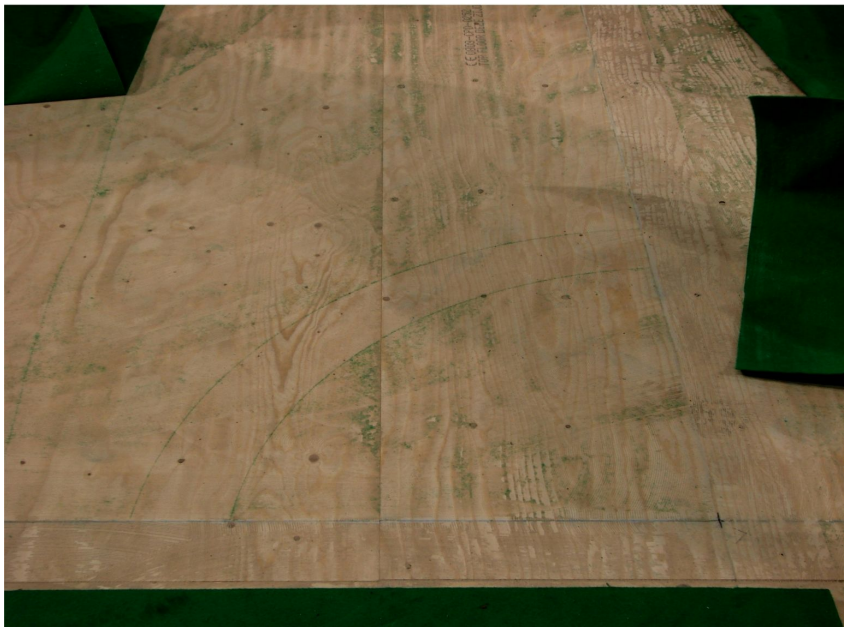


2. Add a **strong border** around the field. Note that the robots may weigh as much as 40 kg, and reach velocities of up to four meters per second, which corresponds to a kinetic energy of 320 Joule. Although robots crashing into the field border will be penalized with a red card, for safety reasons it is fundamental that the field border is build and attached in a way that ensures it can sustain a robot-crash under the described worst-case conditions. Height of the border should be between 8 and 15 cm (above the wooden floor).

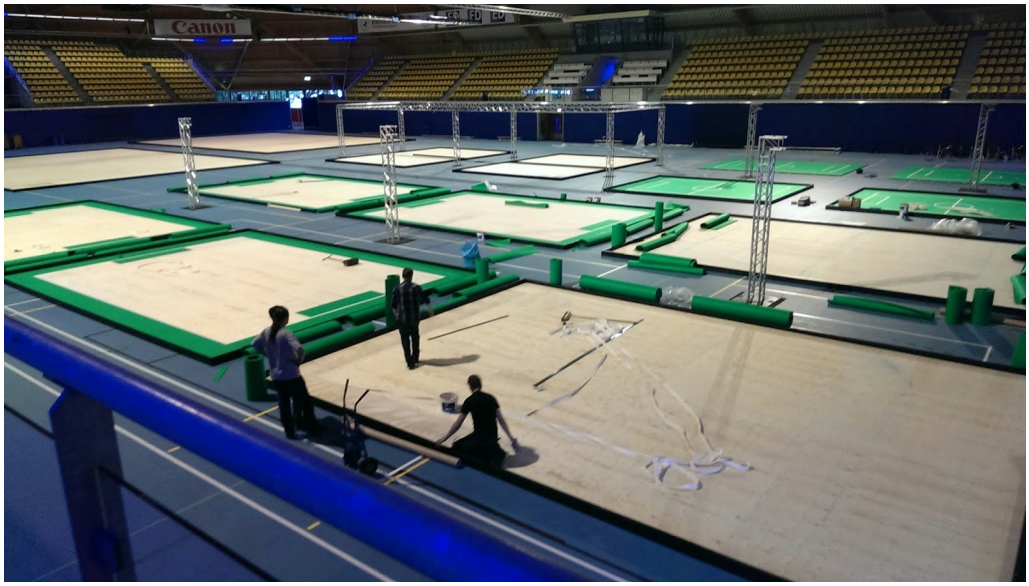




3. Next, draw the lines of the field on the wood.



4. Glue green carpet to the wooden floor at areas of the field that are not covered by white lines, and glue white strips of carpet to the floor where the lines should be.



Using white-colored carpet has proven to be the most reliable way of adding lines to the field. If for some reason this is not possible, using duct tape or white paint are next best solutions. A type of tape that has been successfully used before is: ‘Tesa Extra Power White’, 50mm width, refs 56388-02 or 56389-02. When using paint, please note that several layers are required before green-white contrast becomes sharp enough for the robots to recognize.

5. If necessary, put commercial panels around the absolute border of the field (outside of the 1.5 meter safety region). Panels should be max 1.5 m in width and max 0.5 m in height. They can have any arbitrary color, also colors that match e.g., the color of the ball.

The field is ready for competition!

Required Materials per Competition Field

The number of required fields depends on the number of participating teams. In case multiple fields are used, all of the materials in the table below are required for each of the competition fields. For the 2016 competition, on top of the competition field(s), also a field for the technical challenge will be required (see Technical Challenge, Leipzig, Germany 2016).

Item	#	Description
Field	1	Green carpet, mounted on wooden base, with white markings (for more instructions, see Playing Field Dimensions and Constructing a Field).
Goals	2	White wooden made goals (for more instructions, see Goal Dimensions).
Referee computer	1	Computer running Linux or Windows OS. During a match both teams will connect to this computer, software to do so will be installed by the RoboCup MSL OC.
Access point	1	Either one access point supporting IEEE 802.11a (5GHz) and IEEE 802.11b (2.4GHz) or two separate access points. The access point will stand on the referee table (for more instructions, see Frequently Asked Questions)
Network cable	5	Each approximately three metres in length.
Network switch	1	With at least five slots.
LCDs	2	To connect to the base stations laptops of teams (teams notebooks must be closed during games).
Score board	1	To show the current score during the game. Should be visible both for spectators and team members.
Referee table	1	Table for up to four people.
Referee chairs	4	-
Team tables	4	Two tables at the left and two tables at the right side of the referee table.
Team chairs	8	-
Power plugs	2	2 kW each.

Multi-outlet power strips	2	With at least nine connections.
Whistles	2	For the referee.
Red and yellow cards	2	Preferably plastic.
Tournament ball	3	Color to be decided by OC, FIFA size 5

Nice to have items:

Item	**#**	**Description**
Sound System and Public Announcer	1	To comment games to the audience (explaining what's going on and reporting as a 'Football Commentator').
Referee shirt	3	Special black/grey T-shirt for referees such that everybody can easily identify them.
Chairs for teams	20	Chairs for team members to follow the game.

Other Required Materials

Team Area:

Item	**#**	**Description**
Team tables	-	Enough to provide seating places for all registered team members.
Team chairs	-	One for each registered team member.
Power plugs	-	One per team, 2 kW.
Network/internet cable	-	One per team.

Organizing Committee (OC):

Item	#	Description
Table	1	-
Chairs	3	-
Team leader meeting tables	4	Only in case a specific area for meetings is not available.
Team leader meeting chairs	10	Only in case a specific area for meetings is not available.
Printer	1	Or a dedicated ‘printing point’.
A4 white paper	-	-
Chronometer	2	-
Black obstacles	3	Required for technical challenge. Size: 50x50x80 cm, or 50cm diameter x 80 cm height.
Tape measure	1	At least three meters in length. To check robot specifications and for referee to check robot positioning during free kick in case of objections.
Whiteboard	1	For announcements of OC and publication of results
Pushpin or magnet sticks	50	For sticking schedules and results on the announcements board.
Power plug	1	2 kW
Multi-outlet power strip	1	With at least three outlets.
Network cable	1	Internet connection.
Field repair	-	Tape, tools and other materials needed to repair the field in case of damage.

Public viewing area:

Item	#	Description
Info screen (e.g large LCD)	2	To display relevant information to the audience and teams, such as team info, game schedule, game results, etc.
Computer	1	With windows and office installed.
Video splitter	1	To connect the PC to both info screens.
Info screen connection cable	2	One for each screen.
Power cable	2	One for each screen.

Volunteers:

Item	#	Description
Volunteer	2	At least one in a permanent basis.

Frequently Asked Questions

1. Considering lighting, what are the requirements of the league?

Standard indoor lighting, like tl-lighting for instance, will suffice. We need approximately 600 lux. What's most important is that illumination conditions are equal across the field, such that shadows cast by the robots or other objects are kept to a minimum. Also it's important that lighting conditions don't change during the day. So no direct daylight.

2. How many TVs/projectors will your league need?

We need one TV screen allocated to the MSL competition area, with VGA interface. This TV will be used by the teams to present their work during the Scientific Challenge. The Scientific Challenge is an official challenge for which the winning team is awarded with a trophy.

Television screens for the general public are also nice to have. Content for these screens is usually taken care of by the LOC but we as MSL committee can help of course (e.g., providing the competition schedule with some brief explanation, videos and pictures of previous tournaments etc).

3. What is the ideal SOUND equipment for your league?

Sound equipment is not a requirement for the competition itself, but very valuable for spectators. Especially if the LOC can arrange somebody who can explain what is going on and be a 'football commentator'. Commenting in English would be nice but during previous tournaments the commentators often spoke the native language of the audience, which is nice as well. Have a look at this video for instance:
http://youtu.be/dPa5a9nUCAs

4. In terms of wireless network for league participants, what are the league requirements?

In MSL, wireless communication is a key issue. The game heavily depends on wireless communications and, when conditions are bad, games may have to be interrupted, with an undesired impact on competition schedule as well as on audience expectations about the game. Thus, to minimize communication problems, it is very important to use recognized quality equipment.

Each field of competition is equipped with the following communication elements, which should be provided by the local organizing committee (LOC):

* Two Access Points: one working in IEEE 802.11a and other working in IEEE 802.11b. These two access points may be included in a single piece of equipment.
* One switch with, at least, five ports (and five network cables of at least three metres).

Currently most routers already include one IEEE 802.11a AP, on IEEE 802.11b and a switch, e.g., TP-LINK TL-WDR3600, D-LINK DIR-825.

The league does not have pre-assigned channels. However, if other competitions are expected to be located near the MSL fields, it would be a good practice to predefine channels to the different competitions so that minimal interference occurs.

Page 83 of the rulebook contains info on how the routers need to be configured: http://wiki.robocup.org/images/d/d1/Msl-rules2015.pdf. In addition to the information provided in the rulebook, the AP configuration, regarding SSIDs, should be done in the following way (assuming the venue will have two MSL fields):

Field A:	AP in A mode, SSID: MSL_FIELD_A_a
	AP in B mode, SSID: MSL_FIELD_A_b
Field B:	AP in A mode, SSID: MSL_FIELD_B_a
	AP in B mode, SSID: MSL_FIELD_B_b

5. When will the leagues responsible team (OCs, TCs, EXECs) intent to arrive?

Usually on the first official setup day for teams.

6. WHO will be the responsible for running the league in the venue?

Names of EXEC/TC/OC members are listed here:
http://wiki.robocup.org/wiki/Middle_Size_League#Organization

7. What conditions local organizers should PROVIDE for the arrival of OCs/TCs/EXECs, and what will be made in the venue by OCs/TCs/EXECs?

On the first official setup day we need the fields to be ready. Also the team area needs to be ready with power and internet for each block of tables. For the competition fields the router has to be in place and configured and the referee pc needs to have an operating system running. Software to connect the referee pc to laptops of the participating teams will be installed by us.

8. Will you need any special tools for assembly or maintenance of your league?

Teams will bring their own tools. Other than what's specified in the Required Materials per Competition Field and Other Required Materials we don't need additional tools.

9. Does your league require any other kind of professional to setup?

In order to prepare the fields you'll need a carpenter to create the wooden sub-floor, a 'carpet-professional' for the carpet and/or artificial grass, and a WiFi professional to configure the network. During the tournament it would be good to keep these people on stand-by (not necessarily stand-by on the spot but on a call basis).

12. From your previous experience in RoboCup, what are the usual problems that we can try to avoid for your league?

(i) WiFi interference with other leagues: SSL and Rescue leagues usually cause significant WiFi interference in MSL games. This problem can be minimized if the fields of these leagues are not so close to our fields. (ii) Goals not strong enough. (iii) Border of the field not strong enough. (iv) Carpet damage, especially in the goal area. (v) Lines of the field don't hold. (vi) Poor communication to spectators: The audience needs somebody who explains what is going on and why playing soccer with robots is a challenging scientific problem. (vii) Poor communication via the tournament website: People who are interested in RoboCup soccer but are unable to come to the venue should be kept up to date with respect to standings and preferably also with live reporting.

Technical Challenge, Leipzig, Germany, 2016

In order to boost scientific progress, each year a technical challenge is organized. During this challenge teams have to do something new and innovating (i.e., soccer related task most teams cannot yet do during normal game play). Participation is mandatory for all of the teams that take part in regular competition. Usually, the technical challenge takes approximately half a day and takes place on the second or third day of competition.

For this year's technical challenge, teams will have to show they are able to play soccer on a field of artificial grass (instead of the carpet that is normally used) without the use of wireless communication and while facing natural lighting conditions. Therefore we ask the local organizing committee to arrange an additional, smaller-sized playing field made of artificial grass and located within the atrium part of the venue (figure below).

Atrium Leipzig Messe, technical challenge while facing natural lighting.

The size of this field can be reduced to dimensions defined in the following table. Since no competition matches take place simultaneously with the technical challenge, the goals of the normal playing field can also be used for the technical challenge playing field. Although the playing field will be used less extensively than the fields for normal competition, a strong safety boundary around the field still is necessary (a boundary able to stop a robot driving into it at full speed).

A = 12 m	G = 0.5 m
B = 9 m	H = 2 m
C = ‘width of goal’ + 2.5 m	I = 2 m
D = ‘width of goal’ + 0.5 m	J = 0.1 m

E = 1.75 m	K = 0.15 m
F = 0.6 m	

Since playing soccer on artificial grass is very challenging for most teams we impose some restrictions with respect to the specifications of the grass: The length of the grass-leaves should be less than 8mm (size ‘a’ in the picture below). Thickness of the soft rubber-like material that holds the grass leaves should be around 4 mm (size ‘b’ in the figure). Same as for the normal playing field, the subfloor should be free from surface irregularities that could damage the robot. The grass should not contain sand or dirt.

No referee computer with access point is needed for the technical challenge field. Teams have to complete the challenge without WiFi communication.