

Robô Bombeiro

2017 Rules



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Fire-Fighting Robot Contest

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This document is based on the official “Trinity College Fire-Fighting Home Robot Contest Rules” (used with permission).

These rules and procedures apply to all “Robô Bombeiro” (RB) competitions.

The 2017 RB Contest includes some changes from previous years:

- The technical verifications of the robots will be conducted at the Robot Inspection Table.
- All divisions must use Candle Location Mode.
- Juvenile Division robots must not use any of the following modes: Sound Activates, Arbitrary Start and Variable Door Location.
- The dog is present only in the competition of the Juvenile Division.
- A robot can have only one extinguishing system that can be Air or Non-Air based.
- The Technical Presentation Competition is divided in two groups: Teams from High School and below, and Teams from University and above.

You will find other changes throughout this Rules document; it is your responsibility to build a robot that conforms to the rules applicable to the 2017 Contest.

If you find an error or inconsistency, please send an e-mail reporting it to the Contest Director (Prof. Carlos Carreto ccarreto@ipg.pt).

Chapter 1 - Registration and Eligibility

1.1 Eligibility and Teams

Anyone may enter a robot in the Contest.

The limit on team size is five elements.

In the rest of this document, the term “team” means either the group or the individual associated with a robot entered in the contest.

1.2 Multiple Entries

A team may enter more than one robot. However, in order to qualify for a unique-robot prize, each robot must differ visibly and significantly from other robots of the same team, in at least some aspects of electronics or mechanics. Thus, an individual or team may not register multiple identical robots as separate entries in the same Division.

In terms of the registration procedure, a team with multiple robots must register multiple times. For example, a team with two robots must register two times and choose two different team names.

1.3 Registration

Please follow the direction at <http://robobombeiro.ipg.pt> to register your team. We will accept registration applications until 11:59 p.m. on June 10, 2017.

You must register for the contest until June 10 (midnight), otherwise your robot will not be in the contest.

You have spent hundreds of hours and perhaps as much money on your robot. Register early!

1.4 Fees

A non-refundable registration fee is required for each robot entered into the contest. The fee must accompany each entry.

If you want to enter two robots, then you must build two robots: the same physical robot cannot be entered twice, even if two entry fees are paid.

Notice that *registration fees are non-refundable in any circumstances.*

The Division fees for 2017 are all the same and are equal to 50€. The fees include the registration of 3 elements per team. The team can register more elements (5 maximum)

paying an extra fee of 5€ per element. Notice that if your team includes professors or mentors, these members are part of the team and the extra fee will be applied if the total members are more than 3.

1.5 Adult Assistance

The contest is structured in 4 divisions; Juvenile, Junior, Senior and Walking (see section 3.1). The division structure makes the event more enjoyable for students, but it opens up an area of possible conflict. The problem occurs when a group consisting of students and adults enters a robot in the Juvenile or Junior divisions.

The Contest Jury will decide whether a given robot has been entered in the correct Division based on both the robot's capabilities and the team's abilities.

This does not mean that in a team with students and adults the students have to do everything, i.e., mechanics, hardware, electronics, software completely on their own. On the other hand, we do not want to see improper behavior of an advisor or a mentor such as:

- Spending long periods of time writing and debugging a student's software.
- Working on a robot without the participation of students.
- Performing tasks like testing and calibrating the robot in the arenas.

If this improper behavior is detected, the team will not be able to participate in the competition.

We are less concerned about the role of an adult who helps a team of university or polytechnic students since the team would enter the Senior Division.

Adults helping students is perfectly OK; that's how students learn. Adults taking over the project is not; that's how student learn to cheat.

As far as the students are concerned, the goal of the contest should be education, not winning. We know that the students (sometimes desperately) want to win, but their adult mentors must allow them to compete, win or lose, on their own merits.

This contest runs on the honor system, but we expect that the student contestants bear primary responsibility for their robots. Should we find any case to the contrary, the Jury of the Contest will reassign the robot to a more appropriate Division. In these cases, the decision of the Jury is final.

1.6 Construction Schedule

Teams should build their robots and bring them to the Contest ready to compete: this is *not* a construction contest where you build robots at the event.

We will provide limited time and space for last minute changes, adjustments, and improvements. However, the robots should be completed (or very nearly so) by the time they arrive at the Contest.

1.7 Qualification Trials and Elimination Rounds

The Contest doesn't have qualification trials. Every team registered for the Contest will have the chance to run their robot on the Contest day.

However, in all Divisions, a robot must extinguish the candle in at least one of its first two trials to qualify for a third trial in the competition.

Thus, the first two rounds of the competition serve to eliminate unreliable robots.

1.8 Location, Dates, and Schedule

The RB events will be held at "Pavilhão Desportivo de São Miguel" in the city of Guarda, Portugal, Saturday 8th of July 2017.

The full schedule of events and directions for the Contest day will be posted on the Contest Website at <http://robobombeiro.ipg.pt>.

Chapter 2 - Basic Rules and Procedures

The rules and information in this Chapter apply to all RB robot contests.

These rules change *every year*. Each team is responsible for reading these rules and building a robot that complies with them. Robots designed for previous contests may not be acceptable under the current rules.

2.1 Contest Jury's Rulings

The Contest Jury is the *final* and *absolute* authority on the interpretation of *all* rules and decisions.

2.2 Arena Judge's Rulings

The Arena Judges ensure compliance with the rules of the competition and coordinate the conduct of trials. They prepare the arena scenario and perform the scoring of each trial.

2.3 Appeals

The Judges will use a trial scoring sheet to record the performance of a robot in each trial. When a robot finishes its trial, the Judges will show the trial scoring sheet to a team member that accompanied the trial. The team may challenge any information on the trial scoring sheet by stating that they wish to appeal the problem to the Contest Jury. The Contest Jury will then be called in to decide the matter.

The challenge must be made before the team leaves the arena after the completion of a trial. *All decisions and information in the trial scoring sheet will become irrevocable after the team leaves the arena.*

After each trial, the correspondent trial scoring sheets are processed to obtain the final score of that trial, which is posted for all the teams to see. Teams may challenge the final score of the trial by reporting possible mistakes to the Judges that will analyze the matter.

The challenge of the final score of the trial must be made within 15 minutes after the final score have been posted. *All final scores become irrevocable after the referred 15 minutes.*

Also notice that photographs and videos of the trials will not be taken into account in any appeal situation.

2.4 Safety

Any Arena Judges may stop any robot at any time if, in their opinion, it is performing or is about to perform any action that could be dangerous or hazardous to people, facilities, or other equipment.

Robots must not use highly flammable or explosive materials in any circumstances.

2.5 Dimensions and Accuracy

The goal of the contest is to make a robot that can operate successfully in the real world, not just in the laboratory. Such a robot must be able to operate successfully where there is uncertainty and imprecision, not just under ideal conditions. Therefore, the arena dimensions and other specifications listed below will not be precisely what the robots will encounter at the contest; they are provided as general aids.

NOTE

We recommend designing your robot to cope with a margin for error beyond any stated dimensions. Our experience has shown that robots designed with no margin for error generally suffer from the “But it worked in our classroom/lab/arena!” syndrome.

The size limits on robots are, however, absolute and will be enforced by the Judges.

Object dimensions are generally given as length x width x height, as the robot encounters the object.

- Length is front-to-back
- Width is side-to-side
- Height is top-to-bottom.

2.6 Arena Environment

Although the robot contest arenas present an idealized version of the real world, you must not assume that all corners are exactly square, all walls precisely vertical, all joints flush, all fasteners recessed, all surfaces uniformly colored, and so forth and so on.

Every robot must successfully handle small misalignments, inaccuracies, discolorations, and other arena imperfections. You must test your robot under less-than-ideal conditions and verify that it works properly.

NOTE

Flash photography *will occur* during the entire contest. Your robot *must* withstand frequent sensor glitches from infrared (IR) and ultraviolet (UV) pulses. If your robot operates incorrectly due to external interference from cameras, *it will not be given another trial.*

The contest takes place in a gymnasium that will be quite different from your classroom, laboratory, basement, or living room. Some possible problems you should consider:

- Indirect sunlight and fluorescent illumination: IR and UV radiation interference
- High sound levels: the RB Contest has an enthusiastic crowd
- Reinforced concrete subfloor: random magnetic field anomalies
- Flash photography: frequent IR and UV sensor glitches
- Imperfections and dirt in the arena: sensor and navigation confusion
- The practice arena may not be the contest arena: slight changes in all conditions.

2.7 Practice Time

The contest arenas will be assembled and available for unscheduled test trials during the morning of the contest day.

You should use the practice time to calibrate sensors for the conditions in the gym and to troubleshoot any last minute problems. No team has ever accomplished extensive code development and hardware design during the contest day.

Robots should be built, programmed, and ready to compete on arrival at the contest site. Get busy *now*!

Some teams bring entire practice arenas along to the competition. You may be able to wheedle your way into those arenas, but that depends entirely on your negotiating skills.

Do not expect any significant practice time during the afternoon of the contest day (just before the contest starts), although arenas may be available for a very brief time.

We recommend only one robot in a practice arena at any one time.

NOTE

Please remove your shoes before stepping into the arena! Shoes produce hard-edged dust marks on the floor that may be mistaken for white tape. Stockings produce soft-edged marks that reduce the overall floor contrast. In either case, the arena will be as clean as you leave it.

If two robots collide during practice in an arena and one is damaged, then either:

- Both robots will compete in the contest if the damage can be repaired or
- Neither robot will compete if the damage cannot be repaired.

NOTE

If you put your robot in an arena where another robot is operating and your robot causes irreparable damage, your team and robot will be disqualified from the contest.

The decisions of the Contest Jury concerning:

- damage to a robot
- which team is responsible for any damage
- which teams (if any) may compete
- which teams (if any) will be disqualified
- and all similar questions

are final and cannot be appealed.

We do not monitor practice sessions; *you* are responsible for the safety of *your* robot at all times.

2.8 Power and Facilities

Power will be distributed as 220 VAC 50 Hz. Your equipment must draw less than 2.5 Amp from a single Portuguese-standard 15 Amp outlet.

You must bring along any voltage or frequency converters required to adapt that power to your needs.

You must bring along sufficient extension cords and outlet strips; you will have access to a single outlet that will be close to your assigned table in the pit area.

Because the power distribution involves cables laid on the floor, you *must* assume that power to your devices can be interrupted at any time. People occasionally stumble over the cables and circuit breakers may trip without warning.

NOTE

Utility AC power will *not* be available in the arena area.

Teams *must not* bring extension cords or external power supplies, such as laptop power bricks, into the arena area.

Contestants must bring any and all materials, parts, and test equipment that they may need. The city of Guarda has very few retail suppliers of electronic and mechanical parts; those suppliers are generally closed during weekends.

The gymnasium is well-lighted, but it is not air-conditioned. Summer weather in Guarda tends to be warm and dry, so plan your wardrobe accordingly.

2.9 Technical Verification

Before the contest starts, all the robots entered in the contest shall be subject to technical verification by the Contest Jury. The technical verification is intended to check the compatibility of all aspects of mechanical, electrical, electronic, dimensional, and security of the robots, with the stipulations in this document.

Each team will present its robot at the Robot Inspection Table (RIT) prior to the start of the Contest trials to verify that it meets these specifications:

- Overall size
- Extinguisher capacity
- Position, color and functionality of the Start and Stop buttons.
- Except for Junior Division robots:
 - Microphone position, label, and color
 - Response to the Standard Sound Start Device
 - Operation with standard SPL (Sound Pressure Level)
 - Detection of 3.8 kHz tone using standard contest start device
- Walking mechanism (Walking Division only)
- General conformance to the rules

If there are moving parts other than the drive motors, the fullest extension must be articulated and presented at RIT to verify that it is conforming to the rules. To prevent potential mishandling on the team representative may perform this operation.

A Judge will record the results on the RIT Checklist and explain any problems. You must correct those problems and present the robot again to verify that it meets the requirements.

NOTE

You may present your robot to the Robot Inspection Table twice. A robot that does not pass its second inspection will not compete.

A sample of the most current version of the RIT Checklist will be posted at <http://robobombeiro.ipg.pt> (next to this document).

We recommend that you have another person evaluate your robot using the RIT Checklist. You should resolve all discrepancies before the contest: do not bring a non-conforming robot to the Contest.

NOTE

Robots that do not pass the RIT inspection will not compete in the Contest. The RIT will be open on Saturday morning. If your robot does not pass inspection when the RIT is officially open, the robot will not be able to compete. The competition starts on Saturday after lunch. Check the official program of the event for the schedule of the Technical Verification.

The Contest Jury may conduct further technical verifications whenever needed (before or during a trial, for example). If a robot fails to pass the technical verifications, it can't participate in the contest.

2.10 Trial Options Checklist

Each team will receive 3 Trial Options Checklists (one for each trial), included in the check-in documentation. A sample of the most current version of the Trial Options Checklist will be posted at <http://robobombeiro.ipg.pt> (next to this document).

Before each trial, the Contest Judges will ask the teams to deliver the Trial Options Checklist of the next trial, in which each team indicates the Operation Modes (see section 6.5.1) they chose for the next trial.

Before each trial, the Contest Judges will define a short period of time (10 minutes) for the teams to deliver their Trial Options Checklists.

NOTE

The teams that fail to deliver the document within that time are not allowed to participate in the next trial.

The Trial Options Checklists are used to randomly generate the arena configurations for each team, based on the Operation Modes chosen and the Division. Once completed and delivered the lists cannot be changed.

If a team discovers a mistake on the Trial Run Checklist after presenting it to the Judge, they must choose to either:

- Run the trial using the (erroneous) Modes as entered on the Trial Run Checklist or
- Fail the trial as if the robot had not started.

2.11 Trial Sequence

Before a trial begins, the Contest Judges will ask the teams of a specific Division to put their robots in a “closed park”. This park is a rectangular area on the floor, near the arena where the competition of that Division will take place.

Teams must take their robots to the park as soon as the Contest Judges request it. The Contest Judges will give a few minutes to the teams to complete the task and then the park will be closed, meaning that it will no longer be possible to take the robot to the park. Teams that do not take their robots to the park will not be able to participate in the trial.

After the trial begins, teams will be called in a random sequence. A member of the team must pick up the robot from the closed park when the team’s name is called, and deliver it to the Contest Judge. The team’s name will be called up to 3 times. If no team’s member responds to the calls, the team will not be able to participate in the trial and the Contest Judges will call the next team.

When the robot finishes its trial, the team member must return the robot to the closed park. The robots must remain in the closed park until the last robot completes its trial. The sequence order may change in each trial. Robots make trial runs in the arena in ascending numeric order of a random sequence, so that the robots compete consecutively.

2.12 Starting the Trial

The team must not transfer any information to the robot regarding the layout of the arena, the starting position, or the position of any objects.

Team members must not touch the robot after presenting it to the Judge.

The Judge will determine the location of any objects within the arena, as determined by the robot's Operating Modes (see Section 6.5.1) chosen by the team. The Judge will then place the robot and the objects in the arena.

The Judge will determine when the trial begins and will start the robot by:

- a single press of the Start button or
- triggering the Sound Start device (if Sound Activated Mode was chosen).

2.12.1 Start Button

All robots, including those using Sound Activated Mode, *must* have exactly one Start Button switch that starts the robot.

This button *must* have these characteristics:

- Momentary push-to-operate action (not a toggle switch)
- Located on the top surface of the robot and accessible from above
- A green actuator. You may color the button with a marker, surround the button with a colored area, or use a colored label.

2.12.2 Stop Button

All robots *must* have exactly one Stop Button switch that stops the robot immediately, if necessary.

This button *must* have these characteristics:

- Momentary push-to-operate action (not a toggle switch)
- Located on the top surface of the robot and accessible from above
- A red actuator. You may color the button with a marker, surround the button with a colored area, or use a colored label.

2.12.3 Sound Activation

As described in Section 2.12, the robot may operate in Sound Activated Mode. In that case it will start when it detects a sound of a specific frequency and amplitude.

The robot's microphone must have these characteristics:

- Located on the robot's top surface

- Oriented vertically
- Surround by a blue background.

The Judge will position the Sound Start Device approximately 50 mm away from the microphone and will attempt to align it perpendicular to the microphone's entrance port. Teams *may not request* any particular orientation or distance.

NOTE

Experience has shown that robots detecting only the peak amplitude of the sound will start prematurely due to crowd noise or mechanical shock. See Section 6.5.1.2 for the scoring rules that apply to incorrect operation in Sound Activated Mode.

Robots using Sound Activated Mode *must* also have a Start Button.

2.12.4 Power Switch

The robot may also have a Power Switch that disconnects the robot's batteries.

The team may turn the robot on using the Power Switch after deliver it to the Contest Judge, but the robot *must not* move as a result.

We recommend that robots be turned on and ready to start before being delivered to the Contest Judge, unless that would cause an unsafe condition. Please discuss your robot's operation with the Judges if you anticipate a problem.

NOTE

The Power Switch *cannot* be the Start Button, because activating the Start Button causes the robot to begin operation.

2.12.5 Program Downloading

The team must download any required program or firmware to the robot *before* it is put on the Judge's table or in the closed park. The Judge will press *only* the Start Button or activate the Sound Start Device to start the robot.

2.13 Failure to Start

If the robot fails to start when activated, then the robot has failed the trial.

The Judges will wait for the time described in Section 6.5.2.1, and then record a failed trial. Teams may decide that the robot will not move and terminate the trial before that time by informing the Judge.

This applies regardless of the reason the robot does not start. All that matters is that the robot does not begin moving after the Judge presses the Start Button or activates the Sound Start Device.

Teams *must not* request a re-run following a failure to start.

NOTE

If the robot cannot start or continue the trial due to lack of battery power, is *not* allowed to change or charge the battery and repeat the trial. The robot has failed the trial.

2.14 Premature Start

If a robot begins moving before the Judge has placed it in the arena, it has failed the trial.

If a robot begins moving after being placed in the arena, but before the Judge presses the Start Button or activates the Sound Start Device, it has failed the trial.

Teams must not request a re-run following a premature start.

Chapter 3 - Fire-Fighting Contest Structure

The Robô Bombeiro (RB), contest advances robot technology and knowledge by using robotics as an educational tool. A winning robot must respond to a fire alarm, discover the blaze, and extinguish it in the shortest possible time.

To accomplish that overall task, the robot must start on a signal, explore a typical family home (the arena), locate a fire (a burning candle), extinguish it, and optionally return to its starting point.

3.1 Divisions

In order to make the contest accessible to persons of all ages and skill levels the RB offers prizes in several Divisions:

- Juvenile - Basic-School Grades (up to 13 years old)
- Junior - High-School Grades (up to 18 years old)
- Senior - College/Polytechnic/University, professionals and adult hobbyists (more than 18 years old)
- Walking - Any age

3.1.1 Division Criteria

When registering for the contest, each team must specify the robot's Division. In order to change Divisions, the team must re-register the robot and pay the appropriate registration fee.

The following rules apply to registration.

- Teams that meet the criteria for a particular Division must register in that Division. Teams with mixed membership must register in the division appropriate to the most senior member of the team; e.g., a team with one junior student and three juvenile students, must register in the Junior Division.
- No single robot may be entered in more than one contest Division.
- Robots will compete only in the Division in which they are registered.
- In order to change Divisions, the team must reregister the robot and pay an additional registration fee. Teams may not change Divisions after the registration deadline.
- The Contest Judges may reclassify robots entered in an incorrect Division.
- Entry fees will not be refunded.

NOTE

If the number of registered teams in the Juvenile Division is too small, the teams will be assigned to the Junior Division. The same goes for the teams of Junior Division. In this case the teams will be assigned to the Senior Division. Teams will be informed after the registrations period ends.

Chapter 4 - Scoring and Awards

The scoring system emphasizes reliability by grouping robots according to the number of successful trials.

Within each reliability group, robots are ranked according to score. To earn any award, a robot must complete *at least one* successful trial. Within any contest Division only one prize will be given to any winning robot. However, a robot may win a prize in a contest Division and win one or more special prizes (see next section).

The RB awards cash prizes and non-cash prizes, provided by our contest sponsors. All prizes are described on the Contest Website at <http://robobombeiro.ipg.pt>

Each team participating in the contest will receive a Certificate of Achievement and *one* official contest T-shirt.

4.1 Special Awards

4.1.1 Spirit of an Inventor

The purpose of this award is to reward the most original and innovator robot which may not even win any division awards, but shows the most creativity, ingenuity and true spirit of the inventor. This award will be given in addition to any other prizes that the robot may win.

To qualify for The Spirit of an Inventor award, the robot must:

- Be entered in any Contest Division and
- Show unique concept and design features and
- Complete at least one successful trial by extinguish the candle.

4.1.2 Tiny Robot Award

Although the contest rules for each Division require robots to fit into a specified maximum volume, there is no *minimum* size. We challenge teams to build the smallest robot able to successfully complete at least one of its three trials by extinguish the candle. The robot may compete in any Contest Division.

Size will be determined by measuring the area of the robot's projection on the arena floor - the smallest rectangle enclosing its chassis and all of the projecting sensors, wires, and appendages.

The Judges will measure all robots competing for this prize.

Teams must indicate they intend to compete for this award by completing the respective field of the registration form.

Chapter 5 - Specifications

The arena dimensions and specifications listed below are not exactly what will be encountered at the contest: they are provided as general aids.

The size limits on robots are, however, absolute and will be enforced by the Judges.

5.1 Contest Arena

The Contest Arena layout represents a decorated home, a more realistic fire-fighting environment. Figure 1 shows the layout of the Contest Arena. All the measures presented in the figure are approximate and may vary from arena to arena.

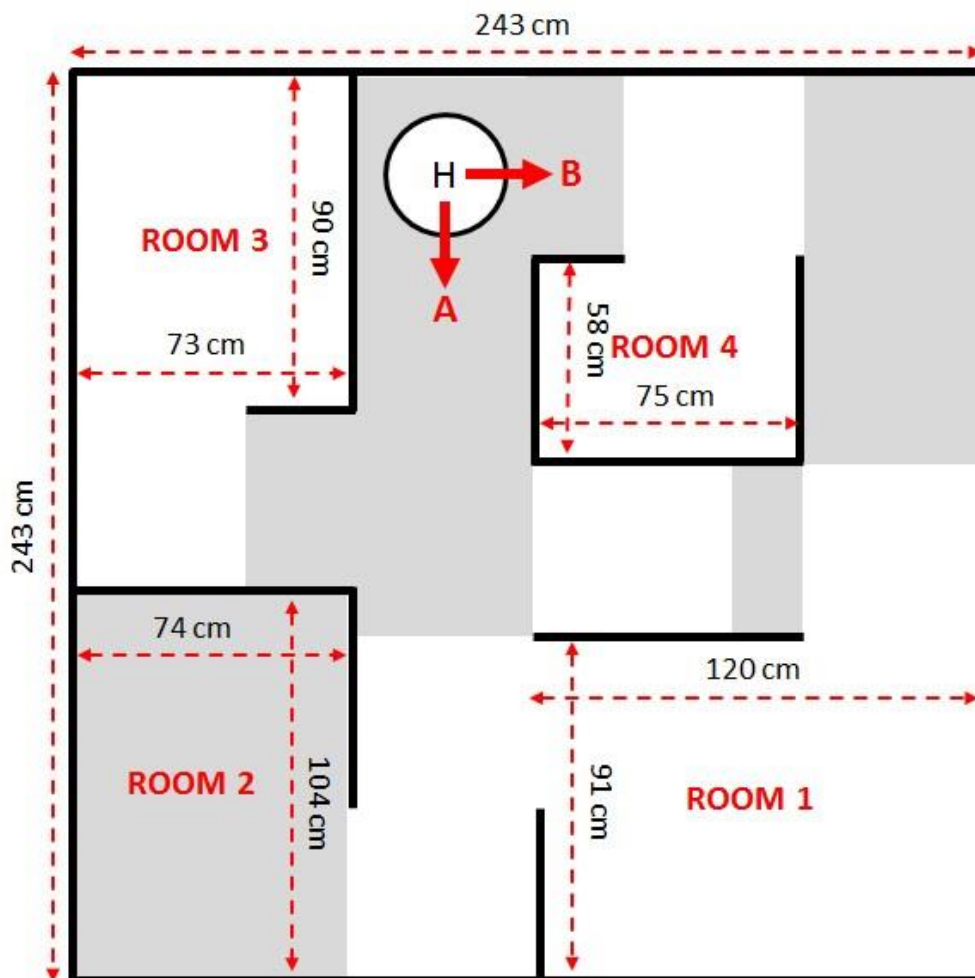


Figure 1: Contest Arena. Shaded areas mark possible rug positions. Red arrows show possible robot start orientations.

Specifications

1. The walls of the arena are approximately 33 cm in height and 1 cm thick.
2. The walls are made of a type of PVC of white color.
3. Angle brackets supporting a wall may extend about 4 cm into the hall or room, with screws into the wall and floor.
4. The floor of the arena is made of a black carpet. Our best efforts will be made to clean up after each robot, but there is no guarantee that the floor will stay uniformly black throughout the entire contest.
5. All hallways and doorways are approximately 46 cm wide. Doorways do not have a door, just a 46 cm opening marked with approximately 2.5 cm wide white strip to indicate the room entrance. The strip may have gaps on each side and may not be precisely aligned with the walls. The white tape marking the doorways has a semi-gloss finish. It will become scuffed and discolored during the contest: your robot must detect the difference between a black floor and a white tape line regardless of their cleanliness.
6. The robot will start at the Home Circle location marked by the H in a circle on the arena floor plan: a 30 cm diameter solid white circle (without the H) centered in the hallway. The orientation of the robot is chosen randomly. See Section 5.2.
7. Rugs will be placed in the Arena. There will be no shag rugs. Shaded areas in figure 1, mark possible rug positions. The rugs can occupy the entire shaded area or part of it.
8. Wall hangings, including pictures, tapestries, and mirrors, might be hung from the walls of rooms and hallways. These will not protrude more than 1 cm from the wall.
9. One or more mirrors may be placed at any place in the arena except in the room where the candle is located.
10. Any rug will not cover up the white tape, but it may be light in color.
11. The arena will be altered when robots use the optional Variable Door Locations mode.

NOTE

We strongly recommend that your robot should not depend on precise dimensions. Our experience shows that the intensity of a protest based on arena dimensions corresponds directly with the robot's failure to operate at all.

5.2 Arbitrary Start Orientation

Except in Arbitrary Start Location Mode (see section 6.5.1.3), the robot will start at the Home Circle location marked by the H in Figure 1; a 30 cm diameter solid white circle, without the H, centered in the halls intersecting at the corner.

NOTE

The Home Circle is not anchored to the arena floor and may be dislodged by an accelerating robot. There is no penalty for this, but the loss of traction may misalign the robot in the hallway.

The robot must start within the Home Circle. The robot parts in contact with the floor must be within the Home Circle.

The Judge will place the robot on the Home Circle so that the central axis of the robot body is aligned within $\pm 10^\circ$ of either hallway axis and the robot's front is directed toward the hallway. The A and B arrows in Figure 1 show the possible orientations. The Judge will randomly choose the orientation for each trial.

Other than the $\pm 10^\circ$ limit, there is no specification for the actual angle with respect to the hallway axis. The robot must start and operate correctly when oriented at any angle within each 20° range.

The robot must determine which hallway it faces and may begin motion in any direction it chooses; a single wall sensor may suffice.

NOTE

A robot in Orientation B may be directly adjacent to and facing the Dog Obstacle. See next section.

Teams must not request a different orientation after the Judge places the robot.

5.3 Dog Obstacle

In the Juvenile Division contest (and only in this division), a large Dog figure (or other animal figure) will block one corridor of each arena. The robot must not move the Dog or continue along the blocked corridor.

The robot may contact the Dog to sense its presence, but must not move it more than 1 cm. A robot that moves the Dog more than 1 cm will incur 50 Penalty Points.

A robot that goes past the Dog, even without moving the Dog, and continues along the hall will fail the trial.

The Dog weighs approximately 500 g. It blocks between 50% and 75% of the hallway width.

The location of the Dog will change from trial to trial. Figure 2 shows the possible locations for the Dog. The Dog's long axis will always be perpendicular to the hall; the picture and figures indicate only the locations.

NOTE

A robot operating in Return Trip mode must not move or pass by the Dog. If it happens, the Return Trip mode fails.

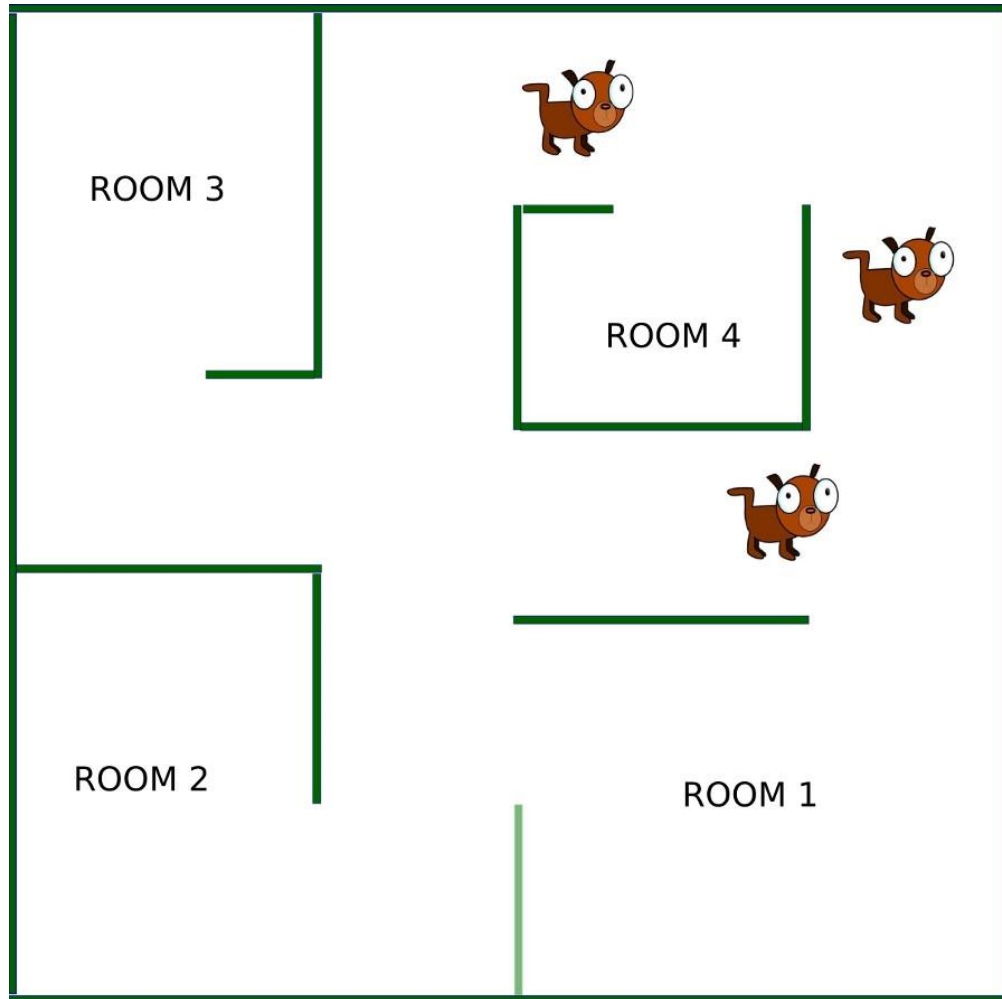


Figure 2: Possible Dog locations

5.4 Robot

5.4.1 Operation

Once turned on, the robot must be autonomous: self-controlled without any human intervention.

A robot may bump into or touch the walls of the arena as it travels, but it cannot mark, dislodge, or damage the walls in doing so. The robot must not leave anything behind as it travels through the arena. It must not make any marks on the floor of the arena that aid in navigation as it travels. Any robot that, in the Judge's opinion, deliberately damages the contest arena (including the walls) will fail that trial. This does not include any accidental marks or scratches made in moving around.

Although a robot may bump the arena walls as it moves, it should not repeatedly crash into the walls at high speed. "Navigation by crashing" would not be acceptable in an actual house and is discouraged in this contest.

NOTE

Also notice that the walls of room 1, may not be firmly secured and may only be in balance on their own bases (with a few centimeters in width). If the robot crashes hard enough to move these walls, the robot must continue with the walls dislocated. If the robot crashes hard enough to collapse these walls, it will fail that trial.

5.4.2 Dimensions

The robot must fit in a Bounding Box with a base 31 x 31 cm square and 31 cm high. If the robot has feelers to sense an object or wall, the feelers will be counted as part of the robot's total dimensions.

Robots competing in the Walking Division may be up to 46 cm long. The width and height remain as described above. The robot *must not exceed the maximum height limit with its legs at full extension*.

NOTE

The weight of the robots in the Walking Division must be support on non-wheeled legs that are also used for locomotion. If it is not the case, the robot cannot compete in the Walking Division and will be assigned to a different one.

Robots must not exceed the maximum dimensions at any time, including while extinguishing the candle. This rule prohibits swinging snuffers, extending arms, and other devices that protrude beyond the allowable base or height dimensions while in operation. Team members must demonstrate the maximum extent of any extending devices to the satisfaction of the Contest Jury during technical verifications.

The robot cannot separate into multiple parts.

Contestants may add a flag, hat, or other purely decorative, non-functional items to the robot as long as the item has absolutely no effect on the operation of the robot.

Unlike the arena specifications, the robot size limits are *not* approximate: robots *must not* exceed the given dimensions.

There are no restrictions on robot weight or materials.

5.4.3 Sensors

There is no restriction on the type of sensors that may be used as long as they do not violate any of the other rules or regulations. The robot must not extend any sensors beyond the dimensions specified earlier.

Robots using laser-based devices must take measures to prevent eye damage to team members and to observers. The Judge may require the team to remove the laser device from the robot if, in the opinion of the qualification Judge, effective safety measures

have not been taken. The robot will be permanently disqualified from competing if the laser cannot be either removed or made safe.

Contestants are not allowed to place any markers, beacons or reflectors on the walls or floors, whether inside or outside of the arena, to aid in the robot's navigation.

5.4.3.1 Sensor Interference

Ambient lighting in the contest room is a mixture of IR, visible, and UV light. During the course of the contest, sunlight may come into the contest room through open outside doors. The sunlight will not shine directly on the arenas, but may be detectable by very sensitive sensors.

During the course of the contest, Judges at other arenas will be lighting candles or lighters. These incidental flames will be above the arena and further away than the candle, but still may be detectable by an indiscriminating sensor. In setting up the arena, contest officials may put their arms into the arena and some very sensitive sensors may mistake that IR emission as the flame.

Many video and still cameras transmit infrared light as part of their automatic focusing systems. Flash units produce bursts of UV that may trigger the popular Hamamatsu UVTron flame sensor. The gymnasium will have many, many cameras at all times: verify that your robot will operate correctly when it's being photographed.

If a robot uses light sensors to find the candle or detect walls or furniture, the robot designer must prevent unintended UV, visible and IR sources from interfering with its operation. Part of the challenge of this contest is to design a robot that can find the flame and ignore everything else.

5.4.4 Power in the arena area

AC Power is not available or allowed in the arena area.

5.5 Fires

For obvious reasons of safety and economy, fires will be simulated by small candle flames.

The base of the candle flame will be from 15 cm to 20 cm above the nominal floor level. The candle thickness will be approximately between 2 cm and 3 cm. The exact height and size of the flame will change throughout the contest depending upon the condition of candle and its surroundings. The robot is required to find the candle no matter what the size of the flame is at that particular moment.

The candle will be placed at random in one of the rooms in the arena. The candle has an equal chance of being in any of the 4 rooms in each of the robot's 3 trials. It is possible for the candle to be in the same room on two of the robot's three trials. If it happens that the candle is placed in the same room for both the 1st and 2nd trials, then the contest

officials will make sure that it is a different room for the third and last trial. Thus every robot will have the candle in at least 2 rooms and possibly 3, during its 3 trials.

The candle will not be placed in a hallway, but it might be placed just inside a doorway of a room.

The contestants cannot measure or touch the candle before it is used. Violation will result in immediate disqualification of the team and the robot from the competition.

The candle will be mounted on a small cylindrical base painted semi-gloss yellow. This base prevents the candle from tipping over easily, but a robot can knock the candle over by bumping into it.

NOTE

The robot will fail the trial if it knocks the candle before extinguishing its flame.

5.5.1 Extinguishing the Flame

The robot must, in the opinion of the Judges, have found the candle before it attempts to put it out. For example, the robot cannot just flood the arena with CO₂ thereby putting the flame out by accident.

The robot must not use any destructive or dangerous methods to put out the candle.

The robot may extinguish the candle by blowing air or other oxygen-bearing gas. However, this is not a practical method of extinguishing a fire in the real world, so robots that do *not* use air streams to blow out the candle can operate in Non-Air Extinguisher Mode (see Section 6.5.1.5) for an improved score.

The robot must signal that it detected the candle flame by lighting a red or blue LED while making an obvious motion towards the flame, and before it attempts to put it out.

We strongly recommend that the robot will turn on the LED a few seconds before it tries to extinguish the flame. The LED fails its propose if it is turned on just at the instant the flame is extinguished. In these situations, the robot will fail the trial.

The LED may stay on or may blink at least until the candle is extinguished. The LED must be mounted on a white background and in plain view so that the judge can see it clearly at all time during each trial.

A penalty is given to robots that touch a lit candle with either the robot chassis or a sensor (see Section 6.5.4).

5.5.2 Methods of extinguishing the flame

Robots may extinguish the flame using air, inert gas, water mist/spray, or mechanical means. The use of powders of any type is not allowed.

1. Air

A fan is an example of an air-based extinguisher. Any robot with a fan or blower cannot use Non-Air Extinguisher Mode.

2. Carbon dioxide (CO₂)

Robots may use a single CO₂ capsule containing up to 16 grams to extinguish the candle on each trial; larger CO₂ containers are prohibited. The Judges will verify that CO₂ is the extinguishing material.

3. Water mist or spray

Water is the only liquid allowed in this contest. You may not add foaming or gelling agents.

The water tank must be transparent and its volume must be no larger than 50 ml. The tank may have a higher capacity but must have a mark indicating the level corresponding to 50 ml. During the technical checks the jury will check the capacity of the tank by filling it with 50 ml of water. The tanks must have a refill tube with a diameter of at least 5 mm, which allows their filling by the jury.

Water must be applied only as a mist or spray, not a jet. Whoever, we will allow a robot to extinguish the flame with no more than three accurately aimed water “bullets”. This would be a water jet with an extremely short pulse, not a continuous stream: think *rifle* rather than *machine gun*. Contact us before you register to verify that your design will be accepted.

Any robot that floods the room will fail that trial.

4. Mechanical means

For example, a wet sponge or a snuffer.

The size limits described earlier apply to mechanical extinguishers: the robot’s moving parts *must not* exceed the maximum size at any time.

Carbon dioxide, water mist, and mechanical means qualify for the non-air extinguisher reduction.

NOTE

A robot can have only one extinguishing system that can be Air or Non-Air based.

5.6 Trial Procedures

The robot must perform certain operations during each trial in the arena. This section describes the overall requirements for each Division. Other sections of this document provide further details.

The robot may use any of the available Operating Modes to improve its score for the trial. The robot may use different Modes in different trials, but the team cannot change Modes after a trial begins.

Each successful trial consists of the following sequence of steps.

1. The robot must start when commanded by the Judge;
2. It must find the candle in one of the rooms;
3. It must extinguish the candle;
4. Optionally, it may return to its starting location if using Return Trip Mode.

5.7 Available Operating Modes

In general, any robot may operate using any of the Operating Modes available in its Division to improve its score.

Table 1 presents the available Operating Modes for each division.

Table 1 – Available Operating Modes for each division.

Operating Modes	Divisions			
	Juvenile	Junior	Walking	Senior
Standard	Required	Required	Required	Required
Sound Activated	Not available	Optional	Optional	Optional
Arbitrary Start	Not available	Optional	Optional	Optional
Return Trip	Optional	Optional	Optional	Optional
Non-air Extinguisher	Optional	Optional	Optional	Optional
Furniture	Optional	Optional	Optional	Optional
Uneven Floor	Not available	Not available	Not available	Not available
Stairs	Not available	Not available	Not available	Not available
Variable Door Location	Not available	Optional	Required	Required
Candle Location	Required	Required	Required	Required

See Section 6.5.1 for a complete description of the Operating Modes.

Chapter 6 - Scoring

Although the scoring system appears complex, it measures differing robot capabilities in different Divisions. The overall scoring flow follows this pattern, with some variations in each Division:

1. The team tells the Judge what optional tasks the robot will attempt; this determines the Operating Mode factors in effect for that trial;
2. The Judge measures the Actual Time required for the robot to complete its trial.
3. The Judge records any penalties;
4. The Judge computes the Operating Score for the trial;
5. The Judge computes the Final Score from the Operating Score and the robot's Division;
6. After the three trials, the Judge computes the Total Final Score from the Final Scores of all three trials.

6.1 Operating Score (OS) Computation

During the trial, the Judges will:

1. Record the robot's Operating Modes (OM.x) options (Section 6.5.1)
2. Measure the Actual Time (AT) for the trial
3. Determine the Room Factor (RF) for the path used
4. Record any Penalty Points (PP) incurred.

After the trial has completed, the Judges calculate the Operating Score (OS) from those values using this procedure:

1. Multiply all of the active Operating Mode values together to find the Mode Factor. If no OM.x factors apply, then $MF = 1.0$
2. Add all of the Penalty Point (PP) values to the Actual Time (AT) to determine the Time Score: $TS = AT + PP$
3. Compute the Operating Score: $OS = TS \times RF \times MF$.

Although the "units" of the Operating Score appear to be seconds, they bear little relation to actual wall-clock time.

6.2 Final Score (FS) Computation

Scoring rules convert the Operating Score into the Final Score for each trial. The Juvenile and Walking Divisions share a slightly different set of scoring rules. The Final

Score becomes a component of the Total Final Score (TFS) used to rank the robots for prizes and awards.

6.2.1 Juvenile Division

If the robot extinguishes the candle, then the Final Score for that trial equals the Operating Score. If it did not extinguish the candle, then the robot receives a score of 600 with credit for tasks completed during the unsuccessful trial by subtracting points as described below.

Room Searching

$\text{TASK.search} = -30 \times \text{number of rooms searched}$

Deduct 30 points for each room searched before finding the candle. The maximum reduction is 120 points because the candle must be in the fourth room.

Candle Detection

$\text{TASK.detect} = -30$

The robot must correctly signal that it detected the candle flame by lighting a red or blue LED while making an obvious motion towards the flame.

Candle Positioning

$\text{TASK.position} = -30$

The robot must move towards the candle and stop within 30 cm of the candle, facing it, and without touching it.

NOTE

Although a robot with only two successful trials can therefore have a lower Total Final Score than a robot with three successful trials, the ranking described in the next section will award higher prizes to the latter.

6.2.2 Junior, Walking and Senior Division

The Final Score is equal to the Operating Score: $\text{FS} = \text{OS}$.

6.3 Total Final Score (TFS) Computation

After all robots within a Division have completed their trials, the Judges compute the Total Final Score (TFS) for each robot by adding all three of its Operating Scores together.

6.4 Ranking Within Divisions

The RB Contest rewards reliable operation by grouping the robots according to the number of successful runs, then according to their Total Final Scores within each group. As a result, a more reliable robot with a worse TFS will outrank a less-reliable robot with a better TFS and be eligible for higher prizes.

The robots in each Division will be divided into four groups based on the number of successful trials: 3, 2, 1, or 0. Within each group, the robots will be ranked on the basis of their Total Final Scores. The First, Second, and Third prizes in each Division will be awarded to the three robots with the smallest TFS in the first group. If the first group has fewer than three robots, then the prizes for that Division will extend to the robots with the smallest TFS in the second group, and similarly to the third group.

In all cases, a robot must extinguish the candle in at least *one* trial to be eligible for any award.

6.5 Score Components

These sections explain how the Judges assign values that determine the Operating Score.

6.5.1 Operating Modes (OM.x)

A robot's overall performance depends on its ability to handle real-world situations. The Basic contest arena includes a level floor, high-contrast walls, and no obstructions, but additional operating modes allow you to improve your robot's score by completing more difficult tasks.

Operating modes act as multipliers to the Actual Time required for the robot to find and extinguish the candle. If no Operating Modes are in effect for a trial, the Actual Time is multiplied by the Standard Mode, which is exactly 1.0.

The team can select different Operating Modes for each of the three trials. Note that the candle and any furniture will be placed in different locations for each trial.

The modes do not apply to an unsuccessful trial.

6.5.1.1 Standard

OM.standard = 1.0

The team must inform the Judge of any operating modes for the current trial *before* the trial begins (see Section 2.10). In the absence of that notification, the robot will compete in Standard Mode and the Actual Time will be multiplied by 1.0.

6.5.1.2 Sound Activated

OM.sound = 0.80

The robot begins operation when it detects a sound signal of approximately 3.8 kHz

Juvenile Division robots must not use sound activation (pushbutton switch starting only).

The Judges will begin timing the trial when the sound signal begins, not when the robot begins moving. The sound will last 5 seconds and *will not be repeated*.

The robot *must not* start until the Judge activates the sound signal. If the robot mistakenly detects ambient noise (even an activation sound from a different arena) and begins to move, then the trial will have begun, but the Sound Activated Mode factor will not apply to the robot's score.

If the robot does not start in response to the sound signal it will *not* be given a second chance to use Sound Activated Mode for that trial. The Judge will attempt to activate the robot by pressing its Start Button.

Judges will use *only* Standard Sound Start Devices. Teams should build their own Sound Start Devices and use them during practice, but may not present them to the Judge during the contest.

NOTE

The robot's circuitry should detect the correct frequency and should not rely only on sound amplitude. We strongly recommend using an analog bandpass filter tuned to the starting frequency: the arenas are very noisy and a robot that detects only amplitude (triggered by whistling or clapping) will start prematurely during its trial.

6.5.1.3 Arbitrary Start

OM.start = 0.75

The Judge will place the robot in an arbitrary location and orientation, within any room that does not have the candle.

Juvenile Division robots must not use this mode.

The robot may be facing a wall or pointed into a corner, but will not be trapped by furniture.

NOTE

Teams *must not* request any particular orientation or position.

There is no Home Circle in Arbitrary Start Mode.

The starting room does not count as a *searched* room for the Room Factor calculation. When the robot leaves the starting room, the *next* room it encounters is its first searched room.

6.5.1.4 Return Trip

OM.return = 0.75

The robot must return to its starting location after extinguishing the flame.

In Standard Mode, the robot must return to the Home Circle. It must stop with any part of its chassis within the 30 cm white Home Circle, but need not be in the same position or orientation as when it started the trial.

In Arbitrary Start Mode, the robot must return to the room it started from. It must stop with all parts of its chassis within the starting room, but need not be in the same position or orientation as when it started the trial.

The robot's Actual Time (AT) recorded for the trial will include only the time required to find and extinguish the candle, not the time for the return trip.

The return trip must be carried out under the following conditions (if not, then the Return Mode factor is not in effect):

- The robot must return its starting location within 2 minutes
- The robot need not retrace its path in returning to the starting location or take the most efficient route, but it must not enter any other rooms along the way
- The robot must not move or pass by the Dog (Juvenile Division only).

6.5.1.5 Non-air Extinguisher

OM.extinguisher = 0.75

The robot must extinguish the candle using inert gas, water, or mechanical means. See section 5.5.2.

Robots that use an air stream of any kind do not operate in Non-air Extinguisher Mode.

6.5.1.6 Furniture

OM.furniture = 0.75

Every room will have one or more pieces of furniture. This includes the room where the robot starts in Arbitrary Start Mode.

Furniture consists of semi-gloss yellow cylinders 11 cm in diameter, 30 cm high and weighing more than 1 kg.

The furniture will *not* block the doorway and a maximum-size robot will be able to come into a room. Furniture may block the robot's view of the candle, so it must move to different locations to see the candle and plan a path to reach it.

The robot may have to go around the furniture to extinguish the candle. It may touch the furniture, but it cannot push it out of the way. Robots that push the furniture away lose the Furniture Mode deduction for that trial.

6.5.1.7 Uneven Floor

The 2017 Contest does not include the Uneven Floor Mode in any Division.

6.5.1.8 Stairs

The 2017 Contest does not include the Stairs Mode in any Division.

6.5.1.9 Variable Door Locations

OM.variabledoor = 0.75

This mode presents uncertainty about the locations of the right-sided room doors.

Juvenile Division robots must not use this mode.

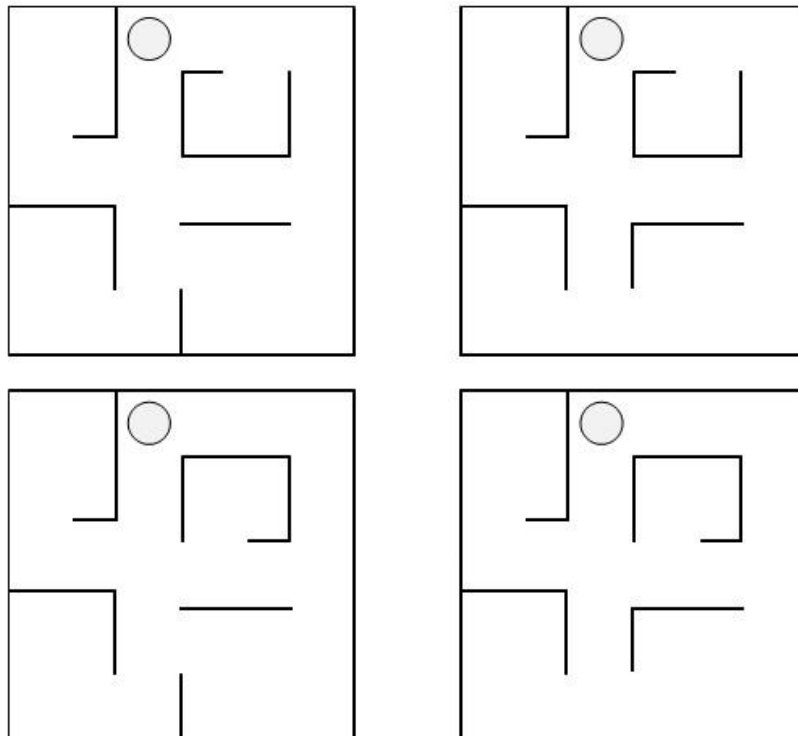


Figure 3: Possible door locations.

At the start of a trial the arena Judge will determine the door locations using a computer-assisted method. Therefore, the robot may encounter a different door location on each trial. Figures 3 show all possible door locations

NOTE

Senior and Walking Divisions robots must use Variable Door Location Mode, so the Mode Factor does not apply in those Divisions.

6.5.1.10 Candle Location

OM.candle = 1

In this year's contest, the Candle Location Mode is required for all divisions, so the Mode Factor is equal to 1.

This mode challenges robots to find candles without any mark identifying the location of the candle (like the Candle Circumference Line in previous editions of the contest). The Judge will place the candle at a randomly chosen location within a room for each trial.

The candle may be in any location within the room that does not block the doorway. A maximum-size robot will be able to come into the room.

The candle won't be directly adjacent to a wall, to reduce the chance of damaging the wall by overheating. There is no specification for the exact distance from the wall.

There are no other restrictions on the candle location in this Mode.

The Fire rules in Section 5.5 will be followed.

Notice that if the Furniture Mode is chosen (see Section 6.5.1.6), the furniture may block the view of the candle from the door, and although the candle or the furniture will not block the doorway, the robot may have to maneuver within the room to detect and extinguish the flame.

6.5.2 Actual Time (AT)

If the robot extinguishes the flame the Actual Time is the number of seconds elapsed from robot activation to flame disappearance. The maximum Actual Time for such a *successful* trial is $AT = 300$ (corresponding to 5 minutes). If the robot does not extinguish the flame within the limits set below, the Judge will terminate the *unsuccessful* trial and assign $AT = 600$.

6.5.2.1 Time Limits

The maximum time allowed for a robot to find the candle is 5 minutes, after which the Judge will stop the trial and assign $AT = 600$.

A robot operating in Return Trip Mode must return to the Home Circle within 2 minutes after extinguishing the candle, after which the Judge will stop the trial. The AT equals the time required to extinguish the candle.

6.5.2.2 Loops and Stalls

If a robot gets stuck in a loop and performs the same (or a similar) movement 5 times in a row without progress, the Judge will stop the trial and assign $AT = 600$.

Any time the robot does not move at all for 30 seconds, the Judge will stop the trial and assign $AT = 600$.

6.5.2.3 Functionality

A robot that fails at both of its first two trials will not receive a third trial.

6.5.3 Room Factor (RF)

The Room Factor (RF) adjusts the elapsed time based on the number of rooms searched. The more rooms a robot searches before it finds the candle, the lower the Room Factor for that trial.

When the candle is in:

- First room searched $RF = 1.0$
- Second room searched $RF = 0.85$
- Third room searched $RF = 0.50$
- Fourth room searched $RF = 0.35$

It does not matter in which order the robot searches the rooms. The only thing that matters is how many rooms the robot has searched before it finds the candle.

When the robot searches the room with the candle, whether or not the robot extinguishes it, the Judge records the Room Factor for that trial. The room factor will not change regardless of how many more rooms the robot searches.

Because some robots can detect the candle by looking in the doorway without entering the room to search it, when the robot passes a doorway for the first time the Judge will count that room as searched. If the robot has already searched a room and then goes past the doorway again on its way to a different room, that room will not be counted twice.

6.5.4 Penalty Points (PP.x)

Penalty Points (PP) will be added to the Actual Time (AT) of any robot that exhibits the behaviors described in this section.

Touching the Candle

PP.candle = 50

Any robot that touches the candle or its base, either deliberately or accidentally, while the candle is lit will have 50 penalty points added to its Actual Time score each time the candle is hit.

There is no penalty for a touch that occurs as part of the actual extinguishing process, i.e., smothering the flame with a wet sponge, or after the candle is extinguished.

Touching refers only to any part of the robot's body, including feelers or probes, and does not include the water, air or other material that the robot might use to extinguish the candle.

Although there is no penalty for touching or knocking the candle over after the robot has extinguished the candle, we *strongly* recommend that your robot avoid doing that. The Judges may not agree with your opinion of whether the candle was extinguished *before* it began falling.

Wall Contact

PP.contact = number of touches

Any robot that touches a wall will have 1 point added to its Actual Time score for each touch.

Continuous Wall Contact

PP.slide = contact seconds

Any robot that slides along a wall will have 1 point added to its Actual Time score for each second that it touches the wall.

A robot may still touch a wall to orient itself, as long as the contact is not sliding.

There is no penalty for touching or sliding along the wall on the Return Trip mode.

Kicking the Dog

PP.dog = 50

Any robot that moves the Dog more than 1 cm will have 50 penalty points added to its Time Score.

The robot may touch the Dog with a sensor probe, as long as the probe does not move the Dog.

A robot that bypasses the Dog and continues along the hall will fail the trial.

Chapter 7 - Technical Presentation Competition

The ability to effectively communicate technical ideas and designs is an increasingly important skill for engineers and scientists. The 2017 RB technical presentation competition aims to encourage the development of such communication skills. We encourage teams to summarize and convey their efforts by designing and delivering a presentation that explains the design and functionality of the robot.

Teams may select from two tracks (or participate in both):

- Traditional scientific poster format
- New media format

For each track, two groups are considered:

- Teams from High School and below
- Teams from University and above

There are, therefore, a total of four prizes; one prizes for each group of each track.

The Poster Format track involves designing a poster following established scientific poster templates as described below. The New Media track encourages teams to use video, audio, and other interactive media formats to present their robot design.

In the Poster Format track, judges will assess displayed posters on the day of the contest, and the top two teams from each group will deliver a five-minute oral presentation using the poster as a visual aid. Posters will be shown on a designated wall. Teams should bring tape or other similar material to attach the posters to the wall.

In the New Media Format track, judges will assess the videos before the contest.

Teams will register for the tracks as part of the web-based registration process. The poster in PDF format and/or a link to the video submission must be submitted to contest organizers email (robobombeiro@ipg.pt) no later than June 30.

7.1 Judging Criteria

Both tracks will be judged based on the same criteria:

Content (40%)

- Problem appropriately described and context given
- Appropriate level of detail provided
- System architecture/overview described

- Appropriate usage of the Portuguese or English language in a scientific context including grammar, style and tone

Visuals (30%)

- Easy to read/see
- Obvious logical sequence and flow
- Useful and appropriate diagrams, photos, etc.

Presentation (30%)

- Appropriate overview/focus, preparation/delivery
- Good articulation
- Appropriate response to judge's questions (Poster Format track only)

Scoring

Each criterion (Content, Visuals, Presentation) will be judged, with each specification earning a score of 0, 5, or 10 points. The points will be summed to produce a total score up to the maximum 100 points.

In the case of the Video Format track, the points of the specification “Appropriate response to the Judge’s questions”, will be equally distributed by the other specifications of the Presentation criteria.

The final score will be the average of the individual score values determined by each Judge.

7.2 Poster Format

The poster presents the design of the team’s firefighting robot. Following traditional scientific poster templates, posters are encouraged to include the following sections and components:

- Abstract/Introduction;
- Problem description/definition;
- Design process;
- System design/schematic;
- Results;
- Conclusions/future improvements;
- Informative diagrams/photos.

The size of the posters must be A0 paper size.

A maximum of two team members may present the poster to the Judges, who are engineers and university faculty. Presentation of the physical robot to the Judges is not permitted. A two-minute question and answer period between the presenters and the Judges will follow.

In Juvenile and Junior Division, presentations must be performed by members different from the professors or the mentors of the team.

All posters and presenters must use Portuguese or English language.

Common Mistakes

Although a *good* poster will build on the points mentioned above, you can make your poster better by following these guidelines:

1. Create a technical poster, not a personal ad for your robot.
2. Use plain backgrounds. Avoid busy patterns and bright colors.
3. Use large, simple fonts. If you cannot read every word on your poster from a distance of 2 meters, neither can the Judges.
4. Describe your robot and project, not your school, your hometown, your friends, or the funny team mascot you made.
5. Do not include large photos of you, your team, or your school. Only the robot matters.
6. Do not include inside jokes about your team. They belong within the team and have no place in a technical presentation.
7. Include technical details of your project, not just a list of robot components. Describe your unique algorithm that processes sensor data, the special wheels you built, or the mechanical innovation that distinguishes your robot from the others.
8. Do not glue robot parts to the poster. Use a camera and include only photos.

Oral Presentation Guidelines

1. Be prepared to explain your team's design decisions and how each component or subsystem functions. The Judges may ask about sensors, navigation algorithms, motor control, propulsion mechanisms, or any other feature of your robot.
2. Practice, practice, practice! If two team members will present the material, practice both the roles and the transitions between them.

Suggestion

A good way to determine whether you have made an effective poster is to hand it to someone who has never seen your work before. Leave the room for five minutes while they look at your poster. When you return, ask them to describe your project to you. If your poster effectively presents the information about your robot project, they will be

7.3 New Media Format

This track encourages the use of video, animation and other computer-aided tools to present the design of a team's firefighting robot. The content of the video or interactive element should be similar to what was described for the poster track (see above), with a maximum duration of four minutes.

In lieu of an on-site presentation during the contest, submissions must be narrated by team members, though they are not required to be "on screen" the entire time.

Submissions must be hosted on streaming websites such as YouTube or Vimeo.

All audio and text used in video submissions must be in Portuguese or English language.