

## **Rescue Rules (2007)**

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*Changes from 2006 rules are highlighted in red.*

### **1. Arena.**

#### **1.1. Description:**

1.1.1. The arena is modular. Each module can be thought of as a "room" in a building. Modules may be placed adjacent to each other (on the same level horizontally) or may be stacked vertically. Modules on the same level are connected by level hallways. Modules on different levels are connected by **a sloping hallway or ramp**.

**A** ramp will not exceed an incline of 25 degrees from the horizontal.

Building plans are linked on this site (see sidebar).

#### **1.2. Size:**

1.2.1. Each module is 48 inches by 36 inches in size (approximately 122 cm by 91 cm) with walls that are 11 inches high (approximately 28 cm).

#### **1.3. Doorways:**

1.3.1. Each room will have 2 doorways in standard locations (see building plans). Robots will enter through one doorway and exit through the other.

#### **1.4. Floor:**

1.4.1. The floor of each room will be a light colour (white, or close to white). The floor may be either smooth or textured (like linoleum or carpet).

1.4.2. The arena should be placed so that the floors are flat and level.

#### **1.5. Line:**

1.5.1. On the floor, there will be a black line for the robots to follow. The black line will be made with standard electrical (insulating) tape, 1 – 2 cm wide. The black line traces a maze on the floor. It may have 90 degree turns in it, turns of other angles, or curves. The line will never cross itself. The line will never come closer than 10 cm to a wall or another line.

1.5.2. The black line will enter and exit each room through the standard doorways. The line will continue along the hallways and ramps so that it creates a single route through all the modules in the arena. Any straight section of the black line running alongside a wall (**in a room or on a ramp**) may have gaps of up to **30** cm in it. A gap in the line may contain a victim.

#### **1.6. Debris:**

1.6.1. Debris may be located in the rooms (but NOT in **a hallway or on a ramp**).

1.6.2. Any section of the black line that is further than 25 cm from the nearest wall may have debris lying across it.

#### **1.7. Graded difficulty:**

1.7.1. It is recommended that the first room (the "Yellow Zone") in the course should NOT contain any gaps or sharp turns in the black line and should be free of debris.

1.7.2. It is recommended that subsequent rooms (the "Orange Zone" and "Red Zone") in the course should be progressively more difficult. (Note that the rooms themselves are NOT coloured. Yellow, orange and red signify easy, intermediate and hard.)

1.7.3. The black line may end at the entrance to the last room (the "Red Zone") in the course, so that robots are required to utilise

some form of search strategy to locate victims and the other doorway (i.e. the exit and finishing line) in that room. Victims may be located anywhere on the floor of that room, but must each be at least 10 cm from the nearest wall.

### **1.8. Victims:**

1.8.1. "Victims" will be located in random positions throughout the course.

1.8.2. Two types of victim may be present:

1.8.2.1. Victims constructed out of green tape;

1.8.2.2. Victims constructed out of aluminized tape or aluminium foil.

1.8.3. The victims will be adhered flat across the black line, **or flat on the floor when located in a gap or in the "Red Zone"**.

1.8.4. The reflectances (**for red light at normal incidence**) of the silver bodies, white (or close to white) floor, green bodies and black line will be well separated, with the following gradation: silver bodies (lightest) > floor > green bodies > black line (darkest).

### **1.9. Lighting:**

1.9.1. Teams must come prepared to calibrate their robots based on the lighting conditions at the venue.

1.9.2. Lighting conditions may vary along the course in the rescue arena.

### **1.10. Magnetic conditions:**

1.10.1. Every effort will be made by the organizers to locate the rescue arena away from magnetic fields such as underfloor wiring and metallic objects. However, sometimes this cannot be avoided.

*Hint: It is recommended that teams design their robots to cope with variations in lighting and magnetic conditions, as these vary from venue to venue. Teams should come prepared to calibrate their robots based on the conditions at the venue.*

## **2. Robots.**

### **2.1. Diameter:**

2.1.1. The upright robot must fit inside an upright 22 cm diameter cylinder.

2.1.2. Robots will be measured with all parts fully extended.

### **2.2. Height:**

2.2.1. The robot height must not exceed 22 cm.

### **2.3. Control:**

2.3.1. Robots must be controlled autonomously.

2.3.2. Robots must be started manually by humans.

2.3.3. The use of remote control of any kind is not allowed.

### **2.4. Team:**

2.4.1. A team shall normally consist of one robot. **(A team may consist of two robots in an international competition. Check the bylaws for the competition.)**

### **2.5. Construction:**

2.5.1. Any robot kit or building blocks, either available on the market or built from raw hardware, may be used, as long as the robot fits the above specifications and as long as the design and construction are primarily and substantially the original work of the students (see section below).

### 3. Inspection.

#### 3.1. Schedule:

3.1.1. The robots will be examined by a panel of referees before the start of the tournament to ensure that they meet the constraints described above.

3.1.2. It is the responsibility of teams to have their robots re-inspected if their robots are modified at any time during the tournament.

#### 3.2. Robot configuration:

3.2.1. While being inspected, each robot must be upright and at its maximum size; i.e. anything that protrudes from the robot must be fully extended.

#### 3.3. Students:

3.3.1. Students will be asked to explain the operation of their robot in order to verify that the construction and programming of the robot are their own work.

3.3.2. Students will be asked questions about their preparation efforts, and may be requested to answer surveys and participate in video-taped interviews for research purposes.

#### 3.4. Violations:

3.4.1. Any violations of the inspection rules will prevent that robot competing until modifications are effected.

3.4.2. However, modifications must be made within the time schedule of the tournament and teams must not delay tournament play while making modifications.

3.4.3. If a robot fails to meet all specifications (even with modification), the robot will be disqualified from that round (but not from the tournament).

3.4.4. If there is excessive mentor assistance or the work on the robots is not substantially original work by the students, then the team will be disqualified from the tournament.

### 4. Play.

#### 4.1. Pre-round setup:

4.1.1. Organizers will make every effort to provide the teams access to the competition area for calibration, testing and tuning before the start of the competition.

4.1.2. Organizers will make every effort to allow at least 5 minutes of setup time before each round.

*Hint: Participants should be aware, however, that situations may arise where these conditions cannot be met; and so participants should arrive prepared to cope **with** conditions that are less than ideal.*

#### 4.2. Length of round:

4.2.1. Robots will be given a maximum time of 10 minutes to complete the course. The time for each round will be kept by the referee.

#### 4.3. Start of play:

4.3.1. To begin, the robot is placed at its starting location in the doorway at the beginning of the black line.

4.3.2. Teams that are late for their starting time will forfeit the round.

#### 4.4. Humans:

4.4.1. In general, movement of robots by humans is not acceptable.

4.4.2. Humans can move robots only when told to do so by the referee.

4.4.3. Before the start of each round, teams should designate one human who will act as "captain", and be allowed to start the robot, based on the stated rules and as directed by the referee.

4.4.4. Other team members (and any spectators) within the vicinity of the rescue arena are to stand at least 60 inches (approximately 150 cm) away from the arena while their robot is active, unless otherwise directed by the referee.

#### 4.5. Objective:

4.5.1. The robots have to follow the black line and attempt to complete the course through the entire arena.

4.5.2. Robots are rewarded for locating "victims" on the course.

4.5.3. Robots are rewarded for successfully negotiating gaps in the black line.

4.5.4. Robots are rewarded for successfully avoiding items of debris blocking the black line.

4.5.5. Robots are rewarded for successfully entering a room through one doorway and exiting through the other doorway.

4.5.6. Robots are rewarded for successfully negotiating a ramp without any assistance.

4.5.7. Robots are penalized for making false victim identifications (i.e. indicating that they have found victims at locations where there aren't any).

4.5.8. Robots are penalized for lack of progress (i.e. whenever human intervention is required to enable them to resume progress along the black line).

#### 4.6. Lack of progress:

4.6.1. Lack of progress occurs if the robot is stuck in the same place or loses the black line for more than 20 seconds.

4.6.2. In cases where lack of progress is due to the robot getting stuck (e.g. oscillating forward and backward or turning in a circle) at a victim or obstacle or getting caught on something (e.g. the edge of a doorway), the referee may pick up the robot and place it back onto the black line a little beyond the cause of the problem, 20 seconds after it first stopped making progress.

4.6.3. In cases where lack of progress is due to the robot losing the black line at a sharp turn, gap, victim or obstacle, the referee may pick up the robot and place it (20 seconds after it lost the line) back onto the line a little beyond the turn/gap/victim/obstacle, for it to attempt to complete the course.

4.6.4. In cases where a robot leaves the black line for no apparent reason, the referee may pick up the robot (after 20 seconds) and return it to the point where it left the line, for it to attempt to complete the course.

4.6.5. The 20-second rule allows the robot some time to recover the line or resume progress along it, without human intervention.

4.6.6. The referee will not turn off the robot or restart its program.

4.6.7. A team may elect to stop the round early if the lack of progress is caused by a faulty robot. In this case, the team captain must indicate to the referee the team's desire to terminate. The team will be awarded all points achieved thus far.

### 5. Scoring.

#### 5.1. Victims:

5.1.1. Ten (10) points are awarded for each victim located by the robot. The robot indicates that it has found a victim by stopping and flashing a lamp for at least two (2) seconds.

5.1.2. Extra points are NOT awarded for the same victim being located more than once.

## 5.2. Gaps in the black line:

5.2.1. Ten (10) points are awarded for each gap in the black line that the robot successfully negotiates (i.e. recovers the line on the far side of the gap).

## 5.3. Debris blocking the black line:

5.3.1. Ten (10) points are awarded for each item of debris blocking the black line that the robot successfully avoids (i.e. moves around the debris and recovers the line).

## 5.4. Rooms:

5.4.1. Ten (10) points are awarded for each room that the robot navigates successfully (i.e. enters through one doorway and exits through the other doorway).

## 5.5. Ramp:

5.5.1. Thirty (30) points are awarded for the robot successfully negotiating a ramp without any assistance.

## 5.6. Penalties:

5.6.1. Two (2) points are deducted for each false victim identification (i.e. whenever a robot indicates that it has found a victim at a location where there isn't one).

5.6.2. Five (5) points are deducted for each lack of progress (i.e. whenever human intervention is required to enable a robot to resume progress along the black line).

## 6. Conflict resolution.

### 6.1. Tie breaks:

6.1.1. Ties in scoring will be resolved on the basis of the time taken by each robot to complete the course.

### 6.2. Referee:

6.2.1. During game play, the referee's decisions are final.

### 6.3. Rule clarification:

6.3.1. Rule clarification may be made by members of the RoboCupJunior International Technical Committee.

### 6.4. Special circumstances:

6.4.1. Specific modifications to the rules to allow for special circumstances, such as unforeseen problems and/or capabilities of a team's robot, may be agreed to at the time of the tournament, provided a majority of the contestants agree.

## 7. Documentation.

### 7.1. Reporting:

7.1.1. All teams must bring written documentation describing their preparation efforts.

### 7.2. Presentation:

7.2.1. Organizers will make every effort to allocate each team a public space (approximately 90 cm by 130 cm) to display their

materials.

7.2.2 Since the public space available at the tournament venue could be limited, teams are encouraged as an alternative to bring some kind of electronic presentation in PowerPoint format.

7.2.3. Posters or electronic presentations should be made in an interesting and entertaining format, as they may be viewed not only by the judges, but also by other teams and the visiting members of the public.

7.2.4. The presentation should provide information about the team and how they prepared for RoboCupJunior. Areas that could be covered include:

7.2.4.1. Team name;

7.2.4.2. Division (primary or secondary);

7.2.4.3. Team members' names and (perhaps) a picture of the team members;

7.2.4.4. Team's country and location within country;

7.2.4.5. Team's school and district;

7.2.4.6. Pictures of the robot under development;

7.2.4.7. Information about the robot and team;

7.2.4.8. Any interesting or unusual features of the robot;

7.2.4.9. What the team hopes to achieve in robotics.

7.2.5. Officials will review the documentation and discuss the contents with team members.

7.2.6. Prizes may be awarded to teams with outstanding presentations.

### 7.3. Sharing:

7.3.1. Teams are encouraged to view one another's presentations.

## 8. Code of Conduct.

### 8.1. Fair Play:

8.1.1. Robots that cause deliberate damage to the arena will be disqualified.

8.1.2. Humans that cause deliberate interference with robots or damage to the arena will be disqualified.

8.1.3. It is expected that the aim of all teams is to participate fairly.

### 8.2. Behaviour:

8.2.1. All movement and behaviour are to be of a subdued nature within the tournament venue.

8.2.2. Competitors are not to enter setup areas of other leagues or other teams, unless expressly invited to do so by team members.

8.2.3. Participants who misbehave may be asked to leave the building and risk being disqualified from the tournament.

8.2.4. These rules will be enforced at the discretion of the referees, officials, tournament organizers and local law enforcement authorities.

### 8.3. Mentors:

8.3.1. Mentors (teachers, parents, chaperones and other adult team members) are not allowed in the student work area.

8.3.2. Sufficient seating will be supplied for mentors to remain in a supervisory capacity around the student work area.

8.3.3. Mentors are not to repair robots or be involved in programming of students' robots.

8.3.4. Mentor interference with robots or referee decisions will result in a warning in the first instance. If this recurs, the team will risk being disqualified.

### 8.4. Sharing:

8.4.1. An understanding that has been a part of world RoboCup competitions is that any technological and curricular developments should be shared with other participants after the competition.

8.4.2. Any developments may be published on the RoboCupJunior website after the event.

8.4.3. This furthers the mission of RoboCupJunior as an educational initiative.

#### **8.5. Spirit:**

8.5.1. It is expected that all participants (students and mentors alike) will respect the RoboCupJunior mission.

8.5.2. The referees and officials will act within the spirit of the event.

8.5.3. **It is not whether you win or lose, but how much you learn that counts!**

#### **Appendix.**

##### **Bylaws for RoboCup 2007 in Atlanta, USA:**

A1. Teams will be paired together to form multinational teams ("multi-teams") of two (2) robots, for half a day (3 hours) at a time. Each team will contribute a robot to its multi-team (i.e. one team cannot provide both robots).

A2. Both robots must start from the same location, at the entrance to the first room (the "Yellow Zone") in the course. The faster robot should be started first, followed by the slower robot after an interval of at least thirty (30) seconds.

A3. The score for each multi-team will be the combined score for their two robots (n.b. victims located by both robots will be counted only once – see rule 5.1.2.). Both teams in the multi-team will have that score added to their own (separate) cumulative scores for the heats.

A4. In both the Primary and Secondary competitions, the twelve individual teams that achieve the highest cumulative scores in the heats will proceed to the finals on the last day of the competitions.

A5. In both the Primary and Secondary competitions, prizes will be awarded to the three individual teams that achieve the highest cumulative scores in the heats, and to the three multi-teams that achieve the highest scores in the finals.

A6. In both the Primary and Secondary competitions, a prize will be awarded to the team with the best presentation.