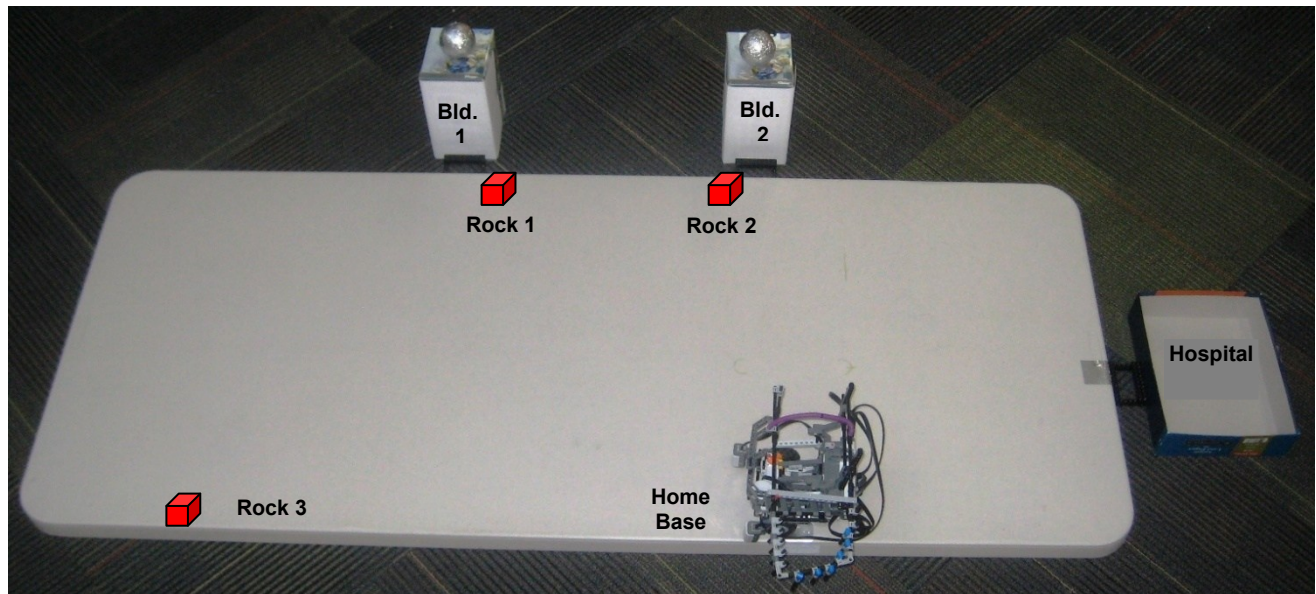# Robots To the Rescue (R2R) - Robofest® 2012 Game

V1.21   1-11-12   (Official version, three corrections after v1.2 are in RED)

[Figure 1] Robots 2 the Rescue (R2R) playing field configuration (Jr. Division)

1. Mission Synopsis

Due to an earthquake, high rise buildings in a city are on fire. An autonomous robot is being sent to rescue people on the top of the two buildings. Missions are ★ Remove rock 3 off the table to clear the south edge road. ★ Move the rock in front of each building any amount. ★ Rescue each individual (tennis ball) on each building. ★ Bring them into the hospital box. ★ Measure the distance between two buildings and report (display) *at the Home Base* the length in millimeters.

Learning Objectives are motion, manipulation, object detection, localization, logic, ratio, proportion, math operations, measuring, trigonometry (Sr. division only), and navigation.

2. How to Play and Score the Game

Each team is given 2 rounds, 2 minutes per round. For each round or age division, the playing field configuration may be different.

Teams will be given 30 minutes after the playing field is unveiled and unknown factors (height of the building and x, y, z for Sr. division) are given. All teams must submit their robot with a team ID tag to the restricted impound area when 30 minutes have expired. The maximum robot width and length is 35cm x 35cm. It may extend its dimension after starting. There is no height limitation. The size will be checked when the robot is impounded. Manual configuration changes made to the robot during the round must meet this size requirement. No team is allowed to download new programs for the round from this moment on.

To start, the robot can be placed anywhere in any orientation in the Home Base area as long as part of it is on or over the foil tape base and meets the size requirements; it may hang over the edges of the table. Players may pick up and modify (add and/or remove parts) their robot without penalty only if any part of the robot is on *or* over the Home Base (foil tape).

If any part of the robot is touched outside of Home Base by a player after the game is started, it must be restarted from Home Base and a penalty will be given. When a penalty occurs, the judge will

show a Red Card and place it in the Hospital box. At that time, the team *may* request **complete reset** or **partial reset** of the playing field. No more than two penalties in total may be assigned per round.

Buildings should not be touched by the robot. If a building moved, penalty points will be given. See the scoring sheet at the end of this document for detailed point and penalty values. Each team must return the robot to the impound area at the end of the round and it must remain there until the next unveiling and prep time.

3. How to Set Up the Playing Field

A 30" x 72" plastic folding table is used for the playing field (See section 8). The surface is light in color; however, the exact color and brightness is unknown until the competition day. The four corners of the table are rounded. Figure 2 shows a possible playing field configuration for Jr. Division. The table should be placed on a dark colored floor with the legs folded under.

Two 5cm x 5cm aluminum foil tape squares will be placed at unknown locations along the edges of the table. The foil square on the south side of the edge is Home Base. The foil square on the east side edge is for the Hospital (H).
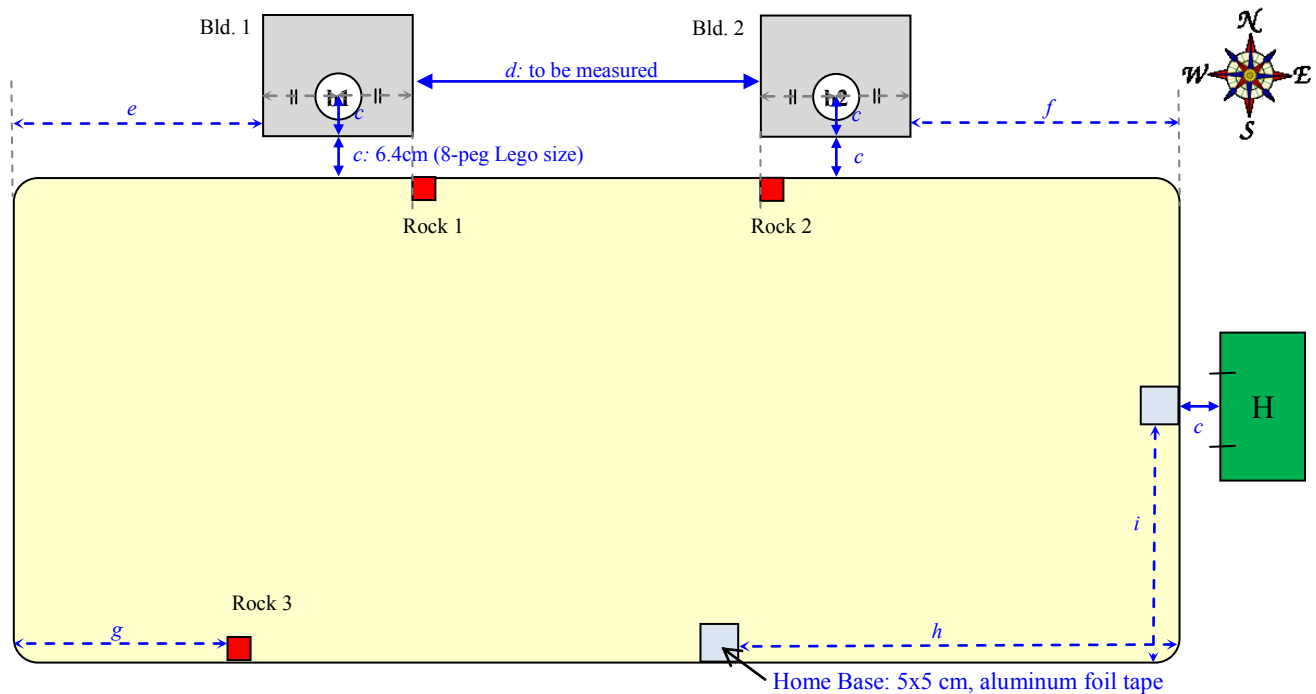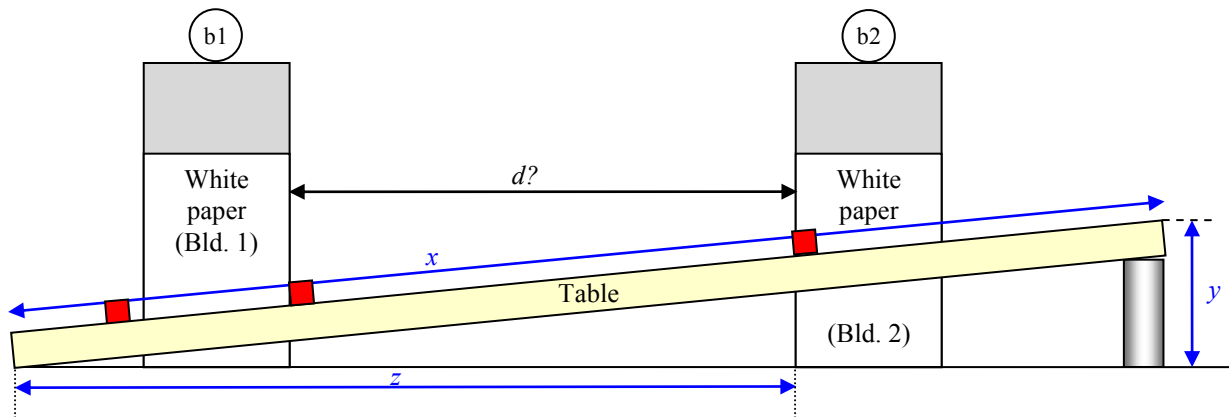

[Figure 2] Jr. Division playing field layout

Along the north side edge, two *identical* boxes representing burning buildings are placed. Width and length of the buildings (Bld. 1, Bld. 2) are unknown, but the range of the width is *10cm* to ~~30~~ *27cm*. Weight of the building is at least 1.5kg. The orientation of the buildings may be different, for example, one portrait and the other landscape. The height of boxes is between 21.6 cm and 45cm and unveiled (announced) for each round. The front side of the buildings is covered with white letter size (8.5 by 11 inches or 215.9 mm × 279.4 mm) paper (see figure 3). A tennis ball wrapped with aluminum foil tape is on the building on a rubber band or Lego rubber tire (figure 3). The location of the ball on the box is centered on the side along the table. The distance from the south-end of the box to the center of the ball is c, 6.4cm as shown in Figure 2. The gap between the buildings and the table is also c (6.4cm) as shown in figure 2. A Lego structure (8-peg Lego size) is used to maintain of the distance, c, between the table and the building as shown in figure 2 and figure 3 pointed by an arrow. A Lego structure built with six 4x2 Lego blocks (figure 3) is placed in front of each building shown

in Figure 2. Rock 1 will be placed in line with the east edge of Bld. 1. Rock 2 will be placed in line with the ~~east~~ west edge of Bld 2. Another Rock "3" is placed at an unknown location on the south side edge. The size of the hospital box is at least 8.5"x11" (letter size paper). The height is between 6.4cm and 9cm. The box is not fixed in place and may be moved if touched. Buildings and the Home Base cannot be placed at the ~~edge~~ four corners of the table. The distances e, f, g, h, and i are at least *21.6* cm.
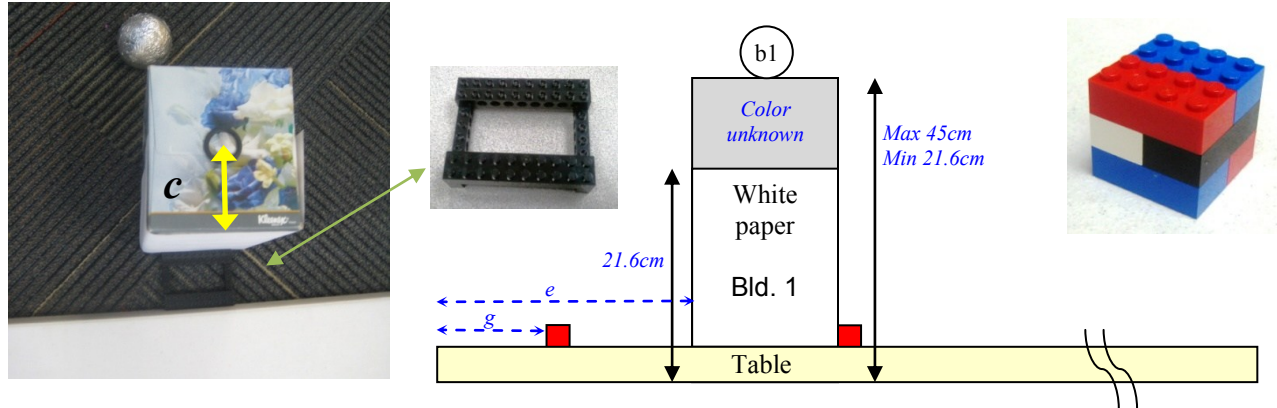
[Figure 3] Building 1 and rock 3 and 1 for Jr. Division

For Sr. division, the unknowns to be unveiled for each round are: *x (table length between 71.5" and 72")*, *y (height of top surface of table over the elevation object, between 9cm and 20cm)*, and *z (distance from west edge to Building 2, between 36" and 59")*. Note that table sizes may vary by manufacturers slightly. Teams are required to measure the table thickness, if needed. Tables from same manufacturer must be used for each competition site.

[Figure 4] Sr. Division playing field layout

4. Differences between Junior and Senior Division

	Junior	Senior
Table angle	zero	unknown
Math skills	trigonometry not required	trigonometry may be required
***Recommended* Programming Language**	Any icon-based graphical language	Any professional text-based language such as C or Java

5. Robot Specifications (For both Jr. and Sr. Division)
- Initial maximum width and length is 35cm x 35cm (it may expand automatically after starting. This size is always checked when starting at the Home Base)
- Height and weight limitation: none

- Only one robot controller for each robot
- Any number of sensors/sensor types (unless it is harmful to humans)
- Any number/type of motors/servo motors. (multiplexor is OK to use)
- Any material/robot kit may be used to construct your robot. Tape, glue, bolts and nuts, rubber bands, etc may be used.
- Team ID tag on top of the robot is required

6. Rules to Play Rounds and Determine Winners

The emcee shall announce the following before each round: *No adult is allowed in the pit area from now through the end of the competition. The use of any communications devices to remotely control robots or communicate with players is prohibited in this competition arena. If anyone sees any suspicious activities, please get the attention of the nearest Robofest volunteer immediately. Only two team members can stay in the competition area.*

Teams will compete in a pre-determined order decided by the site host. The emcee will briefly introduce teams to the general public.

Winners in each division will be decided by the **average** score of the 2 rounds. Tie breakers will be: (1) completion time if perfect score, (2) best score of two rounds, (3) accuracy of the reported distance, (4) rerun, if needed.

Though every effort is made to be consistent and precise, in all of the dimensions of the playing field and parts, Robofest assumes some error of up to plus / minus 0.5cm. Note that Robofest encourages feedback loop control using landmarks, not dead reckoning. Final decisions are at the discretion of the Chief Game Judge.

7. Bill of Materials (BOM) to Construct a Playing Field

	Est. Unit Cost	Quantity	Cost
30" x 72" Folding Table; Suggested tables can be found at: http://www.buylifetime.com/Products/BLT/PID-22901.aspx; Purchase at local discount stores such as Lowe's. Folding tables will be re-used in future Robofest games. Note that the thickness of the table is about 4.5cm.	$50	1	$50
Boxes (reuse any boxes) for buildings, 21.6cm to 45cm high		2	N/A
Lego Block in front of the buildings and on the road		3	N/A
Box for hospital (reuse any box), 21.6cm × 27.9 cm x 8cm		1	N/A
White letter size paper to cover the buildings		2	N/A
Tennis ball	$1	2	$2
Aluminum foil tape	$7	1	$7
Gap maintainer (Lego or any other material such as wood pieces)		3	N/A
Rubber bands		2	$0.10
Total			$59.10

8. FAQs (See for additional FAQs at www.robofest.net/2012.htm)

- Is there a required sequence of missions? No.
- Will there be judging of the team's programs? – No. However, judges may visit team tables to check the code.
- Can teams adjust the height of the robot arm after the building is unveiled? - Yes. Teams may need to bring additional parts. Also, teams may need to bring a tape measure to measure the width of the box, if needed.
- Can we ask reset when the robot is in action? No, only when the robot is at the Home Base.
- Can you ask for a reset when the robot is over Home Base without penalty? Yes. There is no penalty for asking for a reset. Also note that no penalties given if a box is moved and then reset. All the penalties, with the exception of touching the robot or playing field, will be assessed by the judges at the end of the game.

- If we ask for the playing field to be reset, do we lose any points we have already achieved? No. You should ask partial reset.
- Do the judges stop the clock to reset? No
- Can a robot intentionally drop a part? What if a robot drops a part in the hospital box as a means of delivering the ball? Will it get penalty points? No
- What if a robot drives into the hospital box? Obviously, this is an accident. The robot must be picked up. The ball is not saved.
- Can we use a touch sensor to measure the distance between two buildings? – No. If the buildings are touched by the robot *and* moved, then you may get penalties. See score sheet item (7)
- What is the definition of "building move"? That means any noticeable move. Judge's decision is final.
- Must the robot stop at Home Base? No. A player can pick it up at the Home Base without penalty.
- Must robot *stop* to report the distance at the Home Base? No.
- Can a robot still display distance after the 2 min time runs out? Yes. So it is a good strategy to do the display as the last mission.
- Can we get the points of the reporting the distance, if Rock1 and 2 are not moved? No
- Do Rock 1 and 2 have to be moved off the table or just moved? Just moved.
- If the ball bounces out of the hospital box, do you lose points? Yes. The ball is not saved.
- If we are getting the balls off of the building. Can the robot touch the building as long as it does not move the building? Yes, no penalty.
- A robot brings a ball to Home Base. Can you take the ball off the robot by hand at the Home Base? Is it still count as a ball saved on the robot or does it have to physically be on the robot at the end of the game? Judges will check the balls at the end of the game. To get 20 points, it must be on the robot at the end of the game.

Robofest 2012 "Robots To the Rescue" Challenge Scoring Sheet *(v1.0)*

Division: Junior / Senior   Team Name: _____

Team School / Organization Name: _____ Team Number: _____

Round: *First*   *Second*   Track No.: _____

Judging Items *(checked only at the end of a game)*	Count	Point Value (per count)	Score Earned / Lost
(1) Robot reached Building 1 *(Lego block1 is moved)*	0 (no) 1 (yes)	5	
(2) Robot reached Building 2 *(Lego block2 is moved)*	0 (no) 1 (yes)	5	
(3) Rock 3 is removed from the table?	0 (no) 1 (yes)	5	
(4) # of Balls Saved in the Hospital Box	0 1 2	30	
Saved on the Robot	0 1 2	20	
Not on the Buildings	0 1 2	10	
(5) The robot reached building 1 and 2, and reported the distance between them in millimeter at the Home Base: _____ (*)	0 (no) 1 (yes)	20	
(6) The robot remained intact throughout Game?	0 (no) 1 (yes)	5	
(7) Number of buildings moved including Hospital	0 1 2 3	**-5**	
(8) Number of red cards that will be given when human player touches the robot and re-started. (Judges may reset the playing field by request)	0 1 2	**-5**	
Max. score possible is: 100		**Total Score**	
		Time **If perfect score (**)**	(sec. xx)

(*) the acceptable range to earn points will be given to Judges   (**) first tie breaker

Judge initials: _____   *Team player initials:* _____