"Rescue-Bots 2009" – Competition Rules   *updated 2009 June 15*

North Vancouver, 2018: All attempts to regulate access to the Grouse Grind have failed, and throngs of poorly equipped "hikers" now routinely walk up what has become the world's steepest singles club. As a result, the number of search and rescue operations to retrieve stranded lonely hearts has reached astronomical proportions. A new, less demanding means of recovering the hikers must be found. A new crown corporation, Rescuebots Inc, has asked for tenders to construct robots capable of autonomously searching for and rescuing hikers.

I would have been rescued sooner if they had used Rescue-Bots!

You are one of many bidders on a contract to develop a prototype robot to accomplish this task.
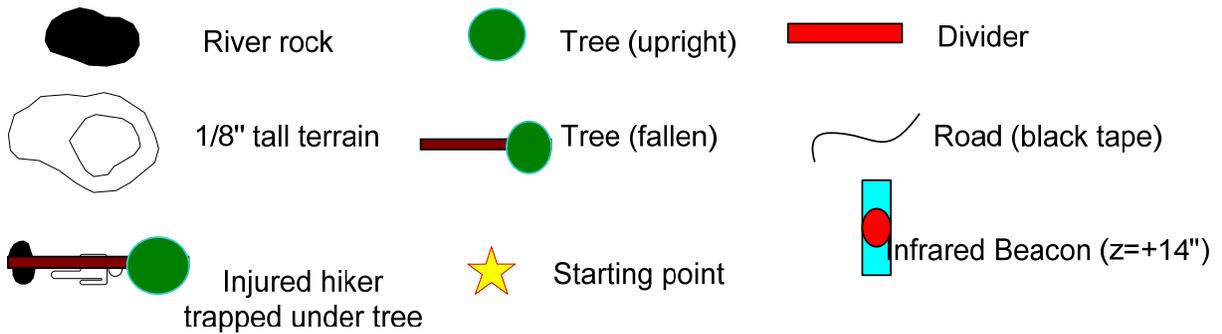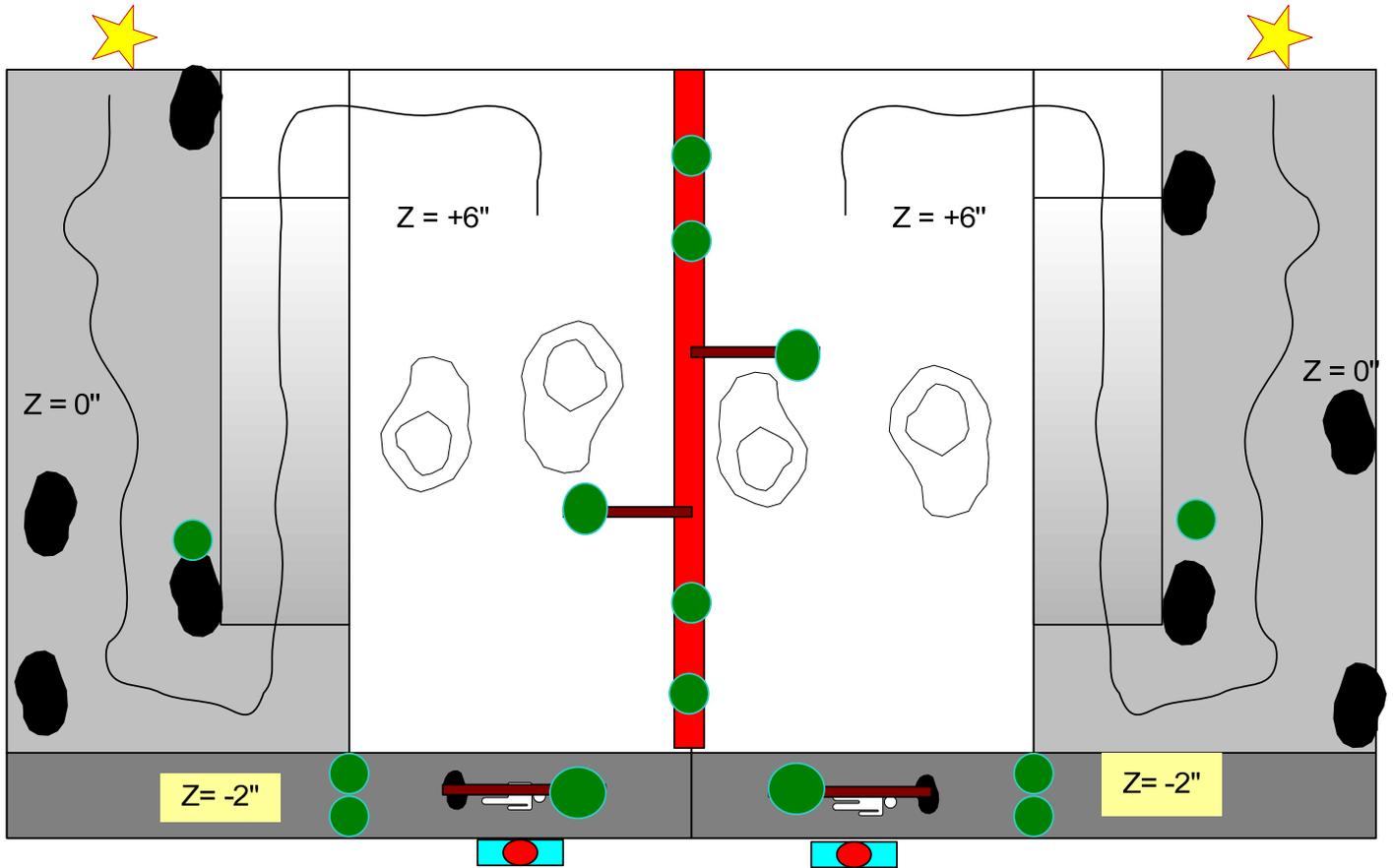
Your robot must be capable of navigating steep and obstacle strewn terrain, reaching and detecting the edge of a ravine or cliff, and reaching down to rescue an incapacitated hiker. To facilitate rescue operations, all hikers will now be equipped with infrared beacons that will help guide the rescue robots.

To help select the winning bid, Rescuebots Inc. is staging a head-to-head contest for prototype robots. You must participate in this competition, which will increase in difficulty as participants are eliminated. The winner will retrieve the hiker in the shortest time.

You will start the rescue on a path leading past rocky terrain, up a hill to a plateau with rough terrain and trees. The road unfortunately ends at the beginning of the plateau, so you will have to navigate by "feel" and /or by the hiker's beacon. A line of trees divides your course from your competitor's, but they can be toppled, so beware of fallen trees in your path. At the end of the plateau is the cliff that the hiker has fallen from – you must reach down to the bottom of this cliff and retrieve the hiker to the safety of the plateau.

One additional danger – the hiker is now trapped underneath a tree! Your robot must be able to clear the tree and get to the hiker up to safety. Good luck!

Playing Surface

Z = +6"

Z = +6"

Z = 0"

Z = 0"

Z = 0"

Z= -2"

Z= -2"

	River rock		Tree (upright)		Divider

	1/8" tall terrain		Tree (fallen)		Road (black tape)

	Injured hiker trapped under tree		Starting point		Infrared Beacon (z=+14")

COMPETITION RULES

1. **Playing Surface**   -   The competition surface is approximately 9' x 16'. The surface is made of wood and will have some warp and slight bumps at the joints and at the ramps. Robots must be designed to accommodate for imperfections and irregularities in the surface.

2. **Fallen Hiker** - The hiker will be a small fabric doll (Ty Teenie Beanie Bopper or similar)– approximately 9" in length and 80g, it will be located directly below cliff, lined up with the IR beacon. The doll and beacon may be positioned anywhere along the 4' long cliff.

3. **Tree on top of Hiker** - a fallen tree will be placed over the fallen hiker. The tree will 1" diameter, with a 12" long stock and will have a 8" diameter spherical treetop. The other side of the tree will be resting on top of a 4" tall rock.   The centreline of both the tree and hiker will be placed 4" away from the surface. Teams may use any means to clear the hiker from underneath the tree – the tree may also go up to the upper plateau, or pushed out of the way to get to the hiker.

4. **Black Electrical Tape** - The "road" will consist of black electrical tape. **There is no minimum radius of curvature on the tape.** The two tracks are not guaranteed to be identical or exactly as shown.   The tape is not guaranteed to be straight at ANY point.

5. **IR Tracking -** The IR beacons will emit a 10 kHz sine wave. Both beacons are mounted so that the emitters are 8" above the plateau surface. There WILL be sources of IR interference during the competition (overhead lights and video cameras) and robots must be able to discriminate the beacons from these noise sources.   You may also accidentally receive IR from your opponent's beacon – you must sort out how to deal with this possibility. However, IR beacons will be oriented to minimize interference with the opponent's signal.

6. **Other Trees** – the upper plateau is divided into two areas by a 1" wide and 2" tall divider. Trees are 1" round wood dowels with a 4" or 5" spherical ball on top. The trees will be set on a small square base to allow tipping in a collision.   Tree placement will only be approximate.

7. **Robot Interference** - Robots may not interfere with each other except by knocking trees down onto the opponent's plateau.   No other form of interference is allowed.

8. **Rescue Completion** - A rescue is successful if the hiker is raised to the plateau level and set down on the upper surface. If the hiker is pushed back over the cliff by the robot, or launched outside the competition surface, it is not considered a successful rescue. The winner of each heat will be determined by the relative progress through the course, and, if both robots are successful, by the time required to complete the rescue.

9. **Restarting Robots** - Robots falling off the competition surface or which are unsuccessful in rescuing the hiker may be rescued by the team and restarted as many times as desired during the heat.   Time during the heat does not stop during a restart.   Judges may allow teams to also recover stuck or incapacitated robots to restart.

10. **Time Limit** - Rescues must be complete in 2 minutes. Additional time may be allowed for heats in the finals.

GENERAL RULES

A. **Autonomy:** Robots must be completely autonomous – no form of remote control is allowed.

B. **Size:**
   a. At the start of the run, the robot must fit inside an area 12"x 18", with a maximum height of 16". Robots may expand once the competition begins.
   b. Robots must fit within the lockers provided in Hebb 42 (approx. 20" x 18" x 24")

C. **Power:** Robots may only be powered by one 12V battery provided plus up to three 9V batteries, unless approved by Course Instructors.

D. **Components**: Out-of-pocket component costs for each robot are limited to $100 per team. All components outside of the list of allowed components at the end of this document must be approved by course instructors.

E. **Playing Surface:** Each competition surface is approximately 8' x 8'. The two courses are completely separate and do not adjoin. The surface is made of wood (MDF painted semi-gloss white) and will have some warp and slight bumps at the joints and at the ramps. Robots must be designed to accommodate this. **The edges of the surface will not have protective rails around the entire surface.**

F. **Damage to Surface:** Robots may not permanently modify or damage to the competition surface or any individual playing piece.

G. **Start Mechanism**: Robots will initiate motion only when the START button on their controller is pressed by a team member at the start of the match (signalled by a referee). Robots may be stopped at any time by the team members. A sequence of button/switch presses on the controller or robot is allowed prior to pressing START to select operating code or parameters.

H. **Track Variations:** There will be two complete competition surfaces constructed for the competition. Tape tracks, infrared emitters and all other objects on the surface will be made similar to one another but are not guaranteed to be identical or exactly as shown in the course map. During each match, teams will be placed on the either of the two competition surfaces at random unless competing teams prefer different surfaces and agree voluntarily on their choice.

I. **Rules Finalization:** Rules and dimensions will change slightly between now and the competition. Finalized rules will be issued after completion of the competition surface construction in Hebb 42. Qualifying heats (with no opponent) will take place a week prior to the competition in Hebb 42.

J. **Sportsmanship Rule**: Strategies or designs that obviate the design elements of the course or that do not follow the intent of the competition will be disallowed whether or not they explicitly break these rules. All strategies which have been designed specifically to come as "close to" violating any of the posted rules as possible must be presented to the course instructors during the design stage of robot building. **All decisions are at the discretion of the course instructors.**

ALLOWED MATERIALS

Approved:

1. Springs, elastics, and compressed air are allowed additional sources of power.

Restricted:
1. Sticky material (e.g. double-sided tape, spray-on adhesive) is not permitted.
2. Discrete H-bridge driver chips.

CLARIFICATIONS:

From 2009 June 1:

1. **Playing Surface Drawing** – changes to the physical layout of the surface shown in the Playing Surface Diagram, including:
    1. additional rock placed on surface close to starting position;
    2. trees in center now replaced with 4" and 5" spherical balls mounted on 1' long tree trunks, 1" diameter.
    3. 1/8" terrain placed across the playing surface
    4. Two trees replace a single rock at the bottom of the cliff.

2. **Max Size During Operation -** The robot may not exceed 3' x 3' x 3' cube at any point during the operation of the run (size measurement done at the judge's discretion). If the robot expands or separates into multiple pieces, the distance between the multiple pieces must all be within the 3' x 3' x 3' cube at all times.

3. **Interference with other robot** – The only allowed interaction between the two robots is knocking trees onto the opponents' side. The use of IR light of any frequency or of projectiles is prohibited.

From 2009 June 15:

4. **Revised Height of Cliff** – The cliff is now 2" below the surface of the platform, instead of 3".

5. **Tree On Top of Hiker** – The wooden blocks holding the tree trunk horizontal above the fallen hiker are not attached to the surface or the tree and can be moved. The block will be placed in the same position at the start of each run. In addition, the rope/spring preventing the tree from falling completely off the surface will be removable, at the team's request.

6. **Resetting Course** – If the run is reset, the fallen hiker and the tree on top of the fallen hiker will be returned to their original position by the course instructors. Trees along the middle of the course which have fallen on the surface will NOT be removed or reset, at the instructor's discretion.

7. **Fallen Trees during Round-Robin, Semi-Finals and Finals** – During the round-robin portion of the competition, trees will be placed in their normal position. As the matches progress through the knockout competition, trees may be knocked down onto the course at the judge's discretion. Trees will be knocked down roughly in the position they would have fallen if struck by one of the robots. There is no limitation as to to which tree, how many trees or the similarity between the two courses.