# MICS 2013 Robotics Contest: Capture the Flag

The MICS 2013 robot contest will consist of two robots playing capture the flag in a grid-world. The grid will be 7 rows by 6 columns of 12"x 12", black, vinyl floor tiles. Even-row tiles will have 0.75" white vinyl electrical tape along all four sides, and odd-row tiles will have white tape only on vertical sides.

Robots will start in opposite corners of the world in their own base. In the outside corner of their base will be their flag. A robot's task is to cross to the opponent's base, capture their flag, and return it to their own base first. Robots will have at most 4 minute to capture their opponent's flag and return it to their base. Navigation of the grid-world will be complicated by up to three obstacles that can be placed within the grid-world. A sample grid without obstacles is shown below.
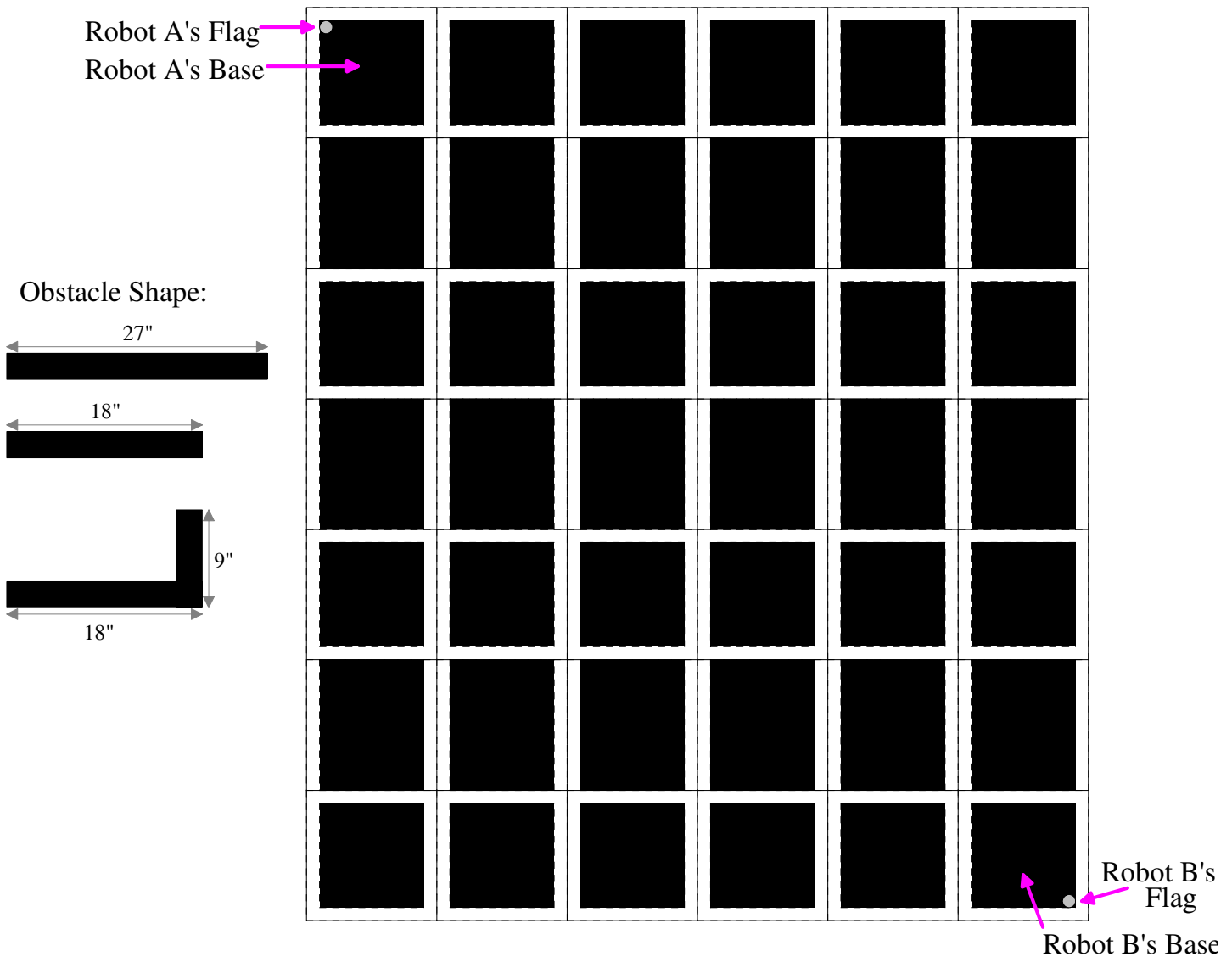
The four obstacles will be painted flat-black and made from 4"x 4" lumber (or two 2-by-4's screwed together). Obstacle shapes are shown on the left side of the diagram. The obstacles will be oriented such that the 4" lumber is centered on grid lines. Bases will be reachable by at least one side which is not along the outer border.

If a robot completely exits the grid-world (i.e., all of its wheels cross the outer border strip), it will be returned to its base by its builder **while the clock is still running**. If the robot has already captured the opponent's flag, the flag will be reset in the opponent's base. The robot must be restarted with the same program being run.

The Winner:

1. The robot successfully capturing the opponent's flag and returning it to their home base in the shortest time is the winner of the match. A tournament of matches will be used to determine the overall winner.
2. If neither robot successfully accomplishes (1), then the robot at the end of the match coming closest to satisfying (1) is the winner. Some examples are needed to help explain the meaning of "coming closest":
   - If robot A captures (holding or pushing) their opponent's flag and robot B does not, then robot A wins.
   - If both robots capture their opponent's flags, then the robot nearest ("as the crow flies" -- ignoring obstacles) to their home base is the winner.
   - If neither robot captures their opponent's flag, then the robot nearest ("as the crow flies" -- ignoring obstacles) to their opponent's base is the winner.

   Only the final state of the world when time expires is considered in (2). If a robot captures its opponent's flag and looses it due to a restart or just drops it, then it has not captured the flag unless it recaptures it and is holding it when time expires.

Additional Rules:

1. Each robot must be fully autonomous, i.e., no communication to an external computer or human operator.
2. The maximum size of a robot at any point in the competition is 12" by 12" by 18" (vertical) include arm(s).
3. A robot which, as determined by the judges, intentionally damages the playing field or opponent's robot in any fashion will be disqualified immediately. This includes leaving any "trail of bread crumbs, " or mark its path in any way. Once a robot is disqualified, the robot shall not be permitted to engage in any additional matches. Pushing on obstacles or the opponent's robot is allowed.
4. At any point during a match, a team can decide to restart their robot from their base, but the clock will continue to run. If the robot has captured the opponent's flag, the flag will be returned to its original location in the opponent's base. The robot must be restarted with the same program being run.
5. A robot should not hold or move their own flag. At any point during a match, a team can request the judge return their opponent's flag to its original location in the outside corner of the opponent's base.
6. The robot will be restarted if it completely exits the grid-world (i.e., all of its wheels cross the outer border strip). It will be returned to its base by its builder **while the clock is still running**. If the robot has already captured the opponent's flag, the flag will be reset in the opponent's base. The robot must be restarted with the same program being run.
7. Robots may NOT be reprogrammed or physically modified between matches. The robot must run the same program when restarted during a match, but any knowledge about the grid-world obtained before it was restarted **can** be retained. The only allowed repair is changing batteries or those necessary to return a robot its original configuration, and these must not result in a delay of the competition.
8. Before the competition starts, all robots must be checked in **and be left with the judges**.
9. Matches are started using the following sequence of events:

   a) teams position their robots such that at least one wheel is touching their base

   b) the judge positions the obstacles

   c) the judges says "Ready, Set, Go"

   d) teams start their robots immediately after the judge says "Go"

10. Any robot that violates the spirit of the contest rules, in the judgment of the organizers, will be eliminated from competition. All decisions by the judges are final!
11. The tiles used in completion are Home Dynamix Flooring: Dynamix Vinyl Tile 1052 Black which can be ordered from: http://www.powersellerusa.com/dynamix-vinyl-tile-10521.html. A box of 20 is about $20, and a box of 30 is about $30.
12. The white strips will be 3/4 (0.75) inch wide, Duck brand 667 Pro Series, white, vinyl electrical tape.

13. An enlarged picture of the flag is shown below. Flags are constructed from three lego pieces and a steel washer:

- gray Technic Gear 40-teeth, part #: 4285634 (or 3649)
- gray Technic Crown Gear 24-teeth, part #: 4211434 (or 3650b)
- black Technic Axle length 6, part #: 370626 (or 3706)
- 3/16" x 1" zinc plated, steel Fender washer (3/16" hole, 1" diameter washer)

Note: The washer will be free to move on the axle.