

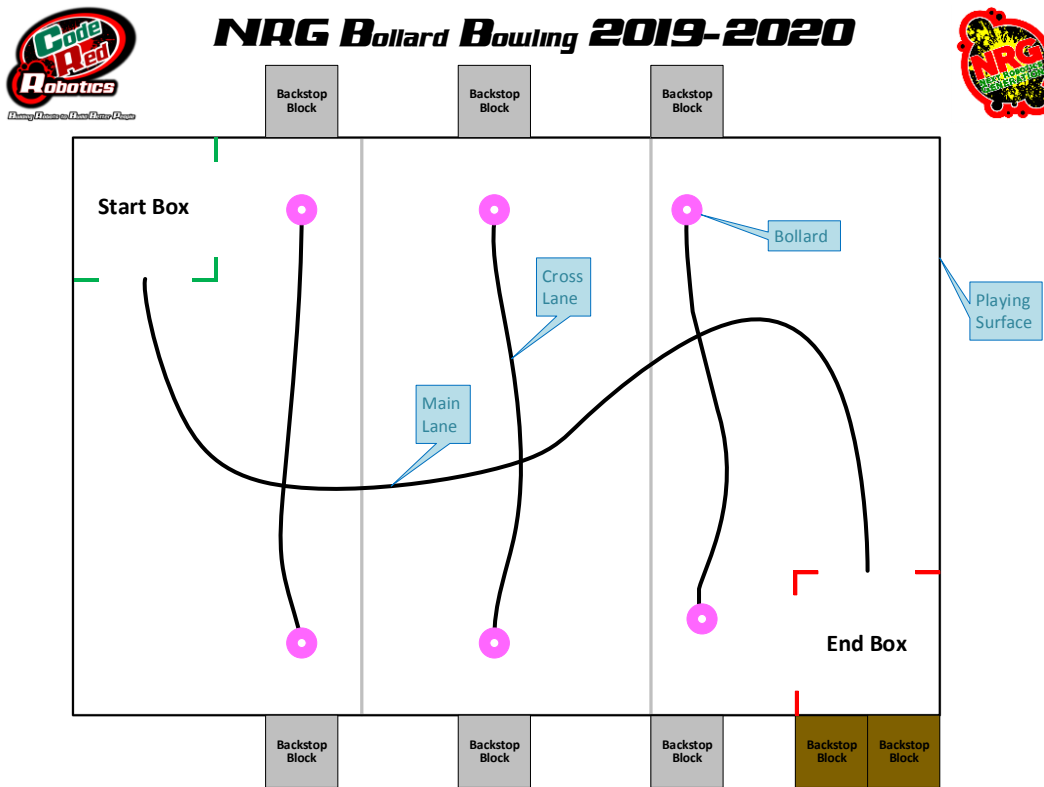
NRG “Bollard Bowling” 2019-2020

Mission Introduction

The year is 2029 and the colonization of planet Mars is well underway. Your company, ACME Construction, is working on building the roads for the first residential development in the **Terra Meridiani** region. The only practical way to build roads on Mars is to use **autonomous construction rovers**.

You now have to deal with a unique situation. Temporary **bollards** were automatically placed at the end of each **cross lane** as they were being constructed. To continue with utility construction, you need to push each bollard off the end of the lane without damaging them. You must program your construction rover to perform this task autonomously.

Game Layout and Elements



As shown in the diagram above, the **Meridiani Gardens Development** consists of a 4 foot by 6 foot white coated Masonite hardboard surrounded by gray and brown 6” foam “**Backstop Block**” cubes. Green ½” wide tape marks the rover **Start Box**, and red ½” wide tape marks the rover **End Box**. ¾” wide black tape marks **road lanes** constructed within the development. Pink pool noodle pieces, 2.5” in diameter and 2” long, represent the temporary **bollards** at the end of each **Cross Lane**.

Game Objective

The game objective is to program your **rover** (or Bob the Mule Bot rover) to navigate the **lanes** in the development and to push the **bollards** off the end of the **cross lanes** without hitting its associated **Backstop Block**. Points are awarded for various actions:

Action	Point Value
Leave the Start Box completely	3
Push a Bollard off the end of a lane	2
“Get it Close” Bonus #1	10 points minus the number of whole centimeters (up to 10) the Bollard stops away from the Backstop Block without touching or going out of bounds.
End with all four rover wheels within the End Box	3
“Get it Close” Bonus #2	10 points minus the number of whole centimeters (up to 10) the Rover stops away from the Backstop Blocks without touching or going out of bounds.
Possible Maximum Score	28

A mission begins with the rover starting fully within the green Start Box area. The rover is powered up in the Start Box and uses its Arduino program you develop to navigate the lanes autonomously. If using line following, you may wiggle the rover to acquire the line within the start area. Otherwise, you may not touch or control the rover during its mission. The mission ends and points are awarded when any one of these conditions occurs:

- The rover stops with all four wheels within the Stop Box. Yea!
- The rover stops for at least five seconds.
- The rover drives “out-of-bounds” off the edge of the white playing surface or “crashes” into a Backstop Block.
- The rover gets stuck in an oscillating loop for at least five seconds.

Points are awarded based on condition of the field after all motion is stopped. **Any Bollard observed to have touched a backstop during a mission will be scored as such even it is rolled away from that backstop later.**

Each **Construction Foreperson** (you) may attempt the course up to two times and choose the best score from the two runs. The top two Rovers from Round 1 will run a second round of single missions to determine first and second place. In the case of a tie, additional matches will be played until the tie is broken.

Rover Programming

You will need to use a combination of the following methods to navigate the development:

- **Line Following:** Use line sensors to follow the black lanes line through the development.
- **Distance Sensing:** Use the rover’s ultrasonic sensor to ping the distance to the Backstop Blocks as the rover pushes a Bollard off the end of a lane.
- **Dead Reckoning:** Program the rover to activate the drive motors for one or more fixed durations without any sensor inputs.

Blocks of example Arduino sketch code will be provided to demonstrate various navigation techniques. They can be incorporated, with minor modifications, into your sketch to run your missions, but more extensive modifications will be needed to be competitive!

Misc.

The Martian Governor (me) reserves the right to modify the mission parameters to account for unforeseen/unintended competitive advantages/disadvantages. The scoring and rulings of the referees during the missions are final and no video replays or photographic evidence will be considered.