Entry Requirements: A Working Rover

Students must be registered for this Student Rover Challenge series by the early submission deadline and must show that the Rover "works". Works is defined by the criteria below.

- Rover can be driven with full control using the processing interface.
- Any pre-programmed steps using the command.txt can be successfully executed.

Rover Score

A total of 600 points is possible in the Rover events. Teams can participate in all three "Sensing Rover" events but only the top two scores will count.

Category	Events & Notes	Possible Points
Sensing Rover	The top two out of three scores for the events below count toward the Team Score. 1. Qualifier. Drive an exact distance. Distances will be assigned randomly. Teams have 5 minutes to update or check code before Rovers are placed on track. 2. Can your Rover drive a straight line? Hint: Use the compass and wheel encoder or gyroscope (not the IR / US sensors). 3. Follow me. Follow a wall. Is your Rover obedient? Can it follow you or a solid object using its ultrasonic sensor? Can it drive a set distance along a wall?	100 per event = 200 (Best 2/3)
Rover Maze	Navigate a maze. Teams will be provided a map and given a set time to update code so the Rover navigates the maze that includes left and right turns. The surface is foammats.	200
Autonomous Rover	Navigate a maze and avoid obstacle autonomously.	200

Rover Event 1, Qualifier

Challenge: The first challenge is to let the Rover measure the distance travelled. Start and finish lines are set up using painter's tape at an exact (freely definable) distance. Measurement rounded to nearest full inch.

Teams have 15 minutes to edit and download sketch to the Rover.

Points = 100, Scaled from 75-point rubric

Testing Criteria: The following criteria are summarized in the evaluation rubric below.

- Front wheels start on the start line. The closer the front wheels are to the finish line at the end of the run, the more points a team receives.
- Rover can be started via the on/ off switch, a press of a push button or remotely from a computer.
- The distance can be written in an Arduino sketch which is uploaded via USB - no additional points are awarded for that. Ideally the distance can simply be transmitted via the serial monitor or even better via processing.
- The distance travelled should be sent back to the computer and displayed there. (HINT Serial Monitor!)

#	Criteria	5 points	15 points	25 points
1	Distance front wheel from Finish Line	More than 2 inches away from the finish line	Wheels are not on the line, but within 2 inches	Both front wheels touch finish line.
2	Distance can be sent to Rover	Rover has to be updated via USB to adjust for different	Distance is sent via the Serial Monitor	Distance is sent via a visual interface
3	Distance travelled is displayed live on screen	No data is sent back to computer	Distance is listed in Serial Monitor	Distance is displayed in a visual interface using processing.

Rover Event 2, Straight Shot

Challenge: Can your Rover go in a straight line without a human directly controlling it? Teams setup the Rover to go in a straight line over 20 feet. The Rover does not have to use sensors; only drive in a straight line over at least 20 feet.

The track is a straight line made out of painter's tape. The Rover's back wheels must touch the starting block before taking off.

Teams have 15 minutes to edit and download sketch to the Rover.

Possible Points = 100

Testing Procedure & Criteria:

- If it does not travel the full 20 feet, enter a score of zero.
- Measure how many inches the Rover deviates laterally from the line.
- Deduct 2 points per inch deviated from the line off the maximum of 40 points.
- Multiply that score by 100/40 to scale the results to 100 points.

Rover Event 3, Follow a Wall

Challenge: Can your Rover follow a wall? Teams setup the Rover so it senses its path along a wall and drives along that wall autonomously.

The track is a path along a wall that's 12 inches high (the wall is the same wall used for Robo RaCeCar testing). The Rover's back wheels must touch the starting block before taking off.

Teams have 15 minutes to edit and download sketch to the Rover.

Possible Points = 100

Testing Procedure

- Mark start and finish lines perpendicular to a wall, at least 20 feet apart.
- Rover is set up on start line at a set distance from the wall.
- Rover has to travel parallel to the wall using only it's sonar sensor and stop just past the finish line.
- Measure the distance between wall and Rover where it came to a stop.

Testing Criteria:

- No Interaction with the Rover - physical or wireless - is allowed while it is driving.
- Exact same distance at start and end = 100 points
- Deduct 10 points from 100 for every inch deviated from the initial measurement.

Rover Event 4, Navigate a Grid (Pre-Programmed)

Challenge: Teams setup the Rover to navigate through a grid of 10 x 10 squares (Each square is 2 ft. x 2 ft.), avoiding squares that are defined as obstacles. The goal is to program the Rover to drive from a start to an end point following the grid.

Teams have the time between registration and their assigned event time to prepare the Rover.

Possible Points = 200, Scaled from 50 point rubric

Testing Procedure

- Teams receive a map of the grid used for this challenge (or can see the actual grid) at registration on competition day.
- Teams position the Rover in the start box. It has to drive to the end point without any interaction.

Testing Criteria: The following criteria are summarized in the evaluation rubric below.

- The course counts as completed if at least one wheel is stopped in the finish square/line.
- The run ends when 2 wheels leave the intended path of travel or are located in a blocked square.
- The Rover need to be re-programmed. Maximum points given for the travel path sent via computer wireless communication.
- Deduct 2 points from final score for each obstacle the Rover hits or accidently moves in its travels.

#	Criteria	0 points	15 points	25 points
1	Completion Rate*	Calculate points as follows: Squares travelled ÷ Squares Not Travelled ×75		
2	Rover Programming	Rover cannot complete the course	Rover must be re-programmed via USB, no GUI interface	Travel Path sent from Computer via Serial Monitor/ Processing

*Example Completion Rate Calculation: Squares Travelled = 11, Squares Not Travelled = 22

Score = 11÷ 22×75= 37.5 Points

Rover Event 5, Fully Autonomous Rover that Avoids Obstacles

Challenge: Completing this challenge takes your team a lot closer to making your Rover fully autonomous. Detect an obstacle in its path, drive around it and continue driving in the original direction. The Rover travels on the same 10x10 square grid as in Rover Event 4 but with obstacles placed in different locations.

Possible Points = up to 100 points

Testing Procedure

- Rover travels towards an obstacle, detects it, avoids it and continues to travel in the original direction.
- Rover must start at least 10 feet in front of the first obstacle. Vary the distance to ensure Rover uses sensor and is not pre-programmed.
- Rover must travel at least 5 feet past obstacle.

#	Criteria	0 points	50 points	100 points
1	Rover Programming	Rover misses or does not detect the obstacle	Obstacle detected and avoided, but did not return to original direction of travel	Obstacle avoided and returned to original direction of travel

Testing Criteria: The following criteria are summarized in the evaluation rubric below.

- No user interaction is allowed.
- Rover cannot touch the obstacle. Deduct 2 points for each hit.