



**MESA YEAR END COMPETITION
CONTEST RULES
Saturday, May 18, 2024**

The MSDV (MESA Self Driving Vehicle)

LEVEL:	Middle and High School
TYPE OF CONTEST:	Team
COMPOSITION OF TEAMS:	4 – 6 students per team
NUMBER OF TEAMS:	3-4 teams per school: 20 teams max overall
BACKGROUND:	<p>The development of self-driving vehicles is becoming an important part of the future of transportation. Whether it be the advancements made in Teslas (https://www.tesla.com/autopilot) or by companies like Waymo (formerly Google’s self-driving vehicle) https://waymo.com/ self-driving vehicles will soon become a bigger part of our everyday life.</p>
OVERVIEW:	<p>Students must construct a robot that will autonomously and efficiently move in a “test neighborhood” (around a “city block”), within a time limit, and come to a full stop. Students will then have to manually control the robot through a “field course” where the vehicle will encounter different terrain and obstacles.</p> <p>The purpose of the competition is to encourage gracious professionalism that leaves everyone involved feeling valued with a sense of integrity and teamwork. The goal is not just to win, but to participate fairly and to extend gracious professionalism and respect to all teams and students involved.</p>
MATERIALS:	<p><i>Middle School</i> Any Lego Mindstorms or SPIKE robot sets</p> <p><i>High School</i> Any Vex Cortex, EXP, V5 or similar kits</p> <p><i>All kits used must have the ability to operate both autonomously and under user control</i></p>

RULES:

1. There are two different components to the challenge. Device must be able to compete in both parts.
2. The first portion is the NEIGHBORHOOD. In this phase the robot must:
 - a. Navigate autonomously through a predetermined (sizes and dimensions will be specified) field.
 - b. Be able to remain within the boundaries of the street and navigate three turns.
 - c. Be able to stop at a red stop sign in the middle of the road. The vehicle must stop within 1 ft from the sign.
 - d. Be able to complete the course in 90 seconds.
3. The second portion of the competition is the FIELD COURSE. In this phase the robot must:
 - a. Navigate through a predetermined (sizes and dimensions will be specified) field. The robot must be manually controlled by a team member.
 - b. Be able to move through a bumpy road patch (a mat of “bubble wrap”).
 - c. Be able to drive over a hill (of cardboard, ~10 degree angle, ~18% grade).
 - d. Be able to drive through a “rainy” puddle of water (an area full of wads of blue construction paper).
 - e. Be able to knock over a vertically standing block of wood (~2 lbs) MIDDLE SCHOOL or a vertically standing brick (~5 lbs) HIGH SCHOOL.
 - f. Be able to complete the course in two minutes. Fastest times get higher scores.
4. Teams will have no more than two minutes to prepare their robot for competition before each trial.
5. A thorough description of the field and objects will be provided.
6. Robots may not exceed 14 inches in length, width or height (MS) and 18 inches in length, width or height (HS)
7. Robots will be required to pass a technical inspection before being cleared to compete.
8. The following types of robot mechanisms and components are NOT allowed:
 - a. Those that could potentially damage playing field components.
 - b. Those that could potentially damage other competing robots.
 - c. Those that pose an unnecessary risk of entanglement.

JUDGING:

For the Neighborhood Course:

1. Teams will be randomly selected for the order of the NEIGHBORHOOD test.

2. Devices will be positioned at a predetermined start line. Contestants will not be allowed to come in contact with the robot once the trial begins.
3. Each run will last no more than 90 seconds and will begin at the judges' signal. Trial will end when the device stops at the stop sign OR the judge signals the end.
4. If a device goes out of bounds (completely outside the boundary of the street), it will be returned to the LAST CORNER it was able to turn. If the device can't make the first turn, device will be returned to the beginning. Time will not be reset if the device goes out of bounds.
5. Robots are allowed at least one race/run, and multiple runs if time allows. Judges will record the fastest time to complete the course (start to finish).
6. If no devices can complete the course, distance traveled (from start to finish) will be measured and used as the metric to score the event. Points will also be awarded for each corner the device is able to turn.
7. User interference will result in a "restart" of the run. The race time will not be paused in these instances.

For the "FIELD COURSE":

8. Order of runs will be randomly chosen.
9. Devices will begin their runs at one of the four starting locations (located before each obstacle/task). Once they overcome one challenge (go from one pre-determined beginning to the end of the obstacle), devices can move on to another challenge, and so forth until all of the challenges are completed, or time expires. Contestants will not be allowed to come in contact with the robot once the trial begins.
10. Each run will conclude when all four challenges are completed OR after a maximum of 2 minutes has passed and will begin and end on the judges' signal.
11. Each robot will be allowed to participate in at least one run.
12. User interference will result in a deduction. Devices will need to be taken to the end of the last task completed and restart from there. Test time will not be paused in these instances.
13. Teams may make changes to their robot between the NEIGHBORHOOD and FIELD portions of the competition. Parts can be added and removed. Only ONE robot will be allowed to compete per team. Please note that all parts used will be inspected. Replacement robots are NOT allowed.

SCORING:

Scoring will be based on the following criteria:

NEIGHBORHOOD

Turning each corner: 10 points first corner
(there are three corners to turn) 5 points each add corner, 20 max points

Stopping at stop sign: 10 points
(vehicle must stop within a foot of the sign)

FIELD COURSE

Completing an obstacle: 5 points, 20 max points
(be able to get completely across an obstacle)

Best time: 20 max points
(we will rank all competition times, and teams will receive a comparison score based on how they rank)

MAX TOTAL: 70 points

TEAMS WITH THE HIGHEST COMBINED SCORE WILL BE DECLARED THE WINNERS.

- Tie-breaker:** The tie breaking procedure is as follows:
- A. Team that completed the courses the fastest
 - B. Team that was able to stop successfully
 - C. Team that completed the most corners

AWARDS:

Medals will be awarded for 1st, 2nd and 3rd place winners based on the total points tallied, per level (Middle School and High School).