

LEVEL:	Middle School/High School
NUMBER OF TEAMS:	One (1) team per school can participate at the MESA Day state competition. Up to three (3) teams can participate at MESA regional events.
TEAM MEMBERS:	Two (2) to Six (6) Students per Team
OBJECTIVE:	Students will design a remote-controlled robot designed to disable an opponent or push an opponent out of bounds. Students will also be required to submit their Design Poster during specification check for review and scoring.
MATERIALS:	Any materials that coincide with the design parameters may be used to build the robot. Hazardous materials are not allowed.

DESIGN PARAMETERS:

1. Size and Materials
 - a. Robots must be no larger than 30 cm x 30 cm x 30 cm in size when in static non-combat mode. Weapons or elements that extend beyond these dimensions once activated to be used during competition are allowed.
 - b. Robots cannot weight more than 450 grams.
 - c. All robots must be the original work of the student teams.
 - d. Pre-manufactured robots or robot kits (i.e. Lego K'nex, Fingertech) are not allowed.
 - e. Parts from pre-manufactured robots and robot kits can be re-purposed and used. For example, motors, wheels, moveable arms, remote control transmitters and receivers.
2. Mobility: All robots must have easily visible and controlled mobility in order to compete. All robots must have a light that indicates that the robot is powered on and systems are active. The light must be easily visible to judges.
3. Control and Batteries: Bots must be remote controlled.
 - a. Teams can use radio controls or microprocessors like Arduino or Micro:Bit.
 - b. Radio controlled systems must have a way to change frequencies or coded channels to prevent radio conflicts. Having at least two frequencies or coded channels available is required. Lack of extra frequencies may result in a forfeit. Digital spread-spectrum radios that use frequency hopping or automatic channel selection qualify under this rule.
 - c. Toy radio systems that have at least two frequencies are allowed.
 - d. Lithium, Nickel Cadmium (Ni-Cad), and wet cell batteries are not allowed.
 - e. Batteries must be placed to protect them from accidental punctures or other damage.
 - f. No autonomous functions are allowed. All physical actions (movement, weapon actuation, etc.) must be remotely controlled at all times.
4. Weapons: Robots are allowed to have active or passive weapons. These include but are not limited to lifters, hammers, clamps, spinning weapons (within limitations, see below), wedges, etc.
 - a. Limitations on Spinning Weapons: All devices rotating more than 360 degrees are allowed to operate with a tip speed at or below 6 m/s.
(Approximate tip speed = no load RPM * diameter in cm * 0.0000523)
 - i. Weapon rpm will be measured by tachometer prior to the start of the event.
 - ii. All weapons operating above the 6 m/s limit must be approved by judges during specification check.
 - b. **Excessively Destructive Weapons.** Weapons deemed too destructive by judges may be further limited or disallowed. Please contact the MESA concerning your design to avoid problems.
 - c. Any weapon systems that may be capable of tearing off pieces of the opponent (flippers, axes, etc.) must be cleared with the judges during specification check.
 - d. All weapons must have a removeable safety device that physically prevents the weapon from operating. The safety device must remain in place until the robot is in the battle arena and ready for combat. Safety devices shall only be removed when directed by the judges.

5. Forbidden Weapons and Materials - The following weapons and materials are absolutely forbidden from use. Weapons that are questionable should be check with MESA before competition.
 - a. Sawing or drilling weapons.
 - b. Weapons designed to cause invisible damage to the other robot (i.e. electrical weapons, rf jammers).
 - c. Weapons or defenses that can reasonably be expected to stop combat completely of both (or more) robots.
 - d. Weapons that would immobilize an opponent for more than 7 seconds are not allowed.
 - e. Weapons that require significant cleanup, or in some way damages the arena to require repair for further matches. This includes but is not limited to liquids, foams, gasses, powder, sand, ball bearings.
 - f. Un-tethered Projectiles.
 - g. Heat and fire
 - h. Light and smoke-based weapons that impair the viewing of robots by an Entrant, Judge, Official or Viewer.
 - i. Hazardous or dangerous materials are forbidden from use anywhere on a robot where they may contact humans, or by way of the robot being damaged (within reason) contact humans.

TESTING PARAMETERS:

1. Two (2) team members are required to be present during testing.
2. A 1.22 m x 1.22 m (+/- 2 cm) plywood surface will be used as the “battle arena.”
3. The “battle arena” will be elevated from the floor between 4 cm and 15 cm.
4. A 60 cm area around the arena surface will be marked as the “safety zone” and during battles no one may enter this space.
5. A 180 cm area around the safety zone will be marked as the “game arena.” Only students participating in the current match can enter the game arena.
6. Teams will be placed in pods for first round battles. Pod size will be determined by the number of teams competing.
7. Teams will compete in at least two battles within their pod during the first round.
8. The top two teams from each pod will move on to a single elimination tournament.
9. Battles will last until there is only one robot still moving on the battle arena or 3 minutes, whichever comes first.
10. The battle sequence will be:
 - a. Teams enter the game area and place their controllers on the ground.
 - b. Teams place their robots on battle arena when directed by the judge.
 - c. Power up robots (power light on).
 - d. Remove safety devices.
 - e. Establish communication with robot, verify control & non-interference.
 - f. Judge gives 5 second countdown. Announces the start of battle.
 - g. Battle continues for 3 minutes or until there is one winner.
 - h. Judge declares battle over.
 - i. All teams turn off controllers and place them on the ground.
 - j. Teams power down robots and reinstall safety devices if possible.
 - k. Teams remove robots and controllers from battle arena and game area.

MINIMUM SAFETY EQUIPMENT:

1. All team members participating must wear plastic hard hats and goggles.
2. Team members shall remain outside the safety zone during battles
3. Teams should bring their own safety equipment. A set of hard hats and goggles will be available at the event if needed.

SPECIFICATION CHECK:

1. During specification check, all teams will check in to the competition area and submit their robots for inspection and impounding. Teams not arriving during spec check will be receive a score of zero. See event agenda for exact times.
2. Students must remain with their robots during spec check to answer any questions from the judges about their robot.
3. At spec check, each robot will receive a specification check to determine whether it conforms to dimensions, materials, and construction rules. Any robot that fails spec check will be given a performance score of zero.

4. Judges **may disqualify** any entry if, in their opinion, the robot might create a safety hazard for spectators, team members, or property (i.e. sharp edges).
5. Robots must be in testing condition prior to device inspection. If devices are disqualified during inspection check, design changes will not be allowed. Only devices passing inspection will be allowed to participate in the performance tasks.
6. Repairs are allowed, replacement parts and materials only, and all repairs must be done in the impound area under supervision of a judge. The addition or exchange of parts that, in the opinion of the judge, would alter the design or function of the robot is NOT allowed. No tools or supplies will be available at the event. Teams should bring any tools and repair materials with them.
7. All repair materials to be used during the competition must be impounded with the robot. Tools may be kept by the team and need not be impounded. MESA will not provide tools.
8. After clearing specification check, all robots will be impounded until testing.

JUDGING:

1. During first round battles, all robots will be scored in the following categories:
 - Damage: the amount of damage done to their opponent
 - Durability: the amount of damage sustained from opponent's attacks
 - Aggression: engagement in the battle, initiation of contact, use of weapons
 - Control: ability to effectively maneuver robot around the arena and during combat
2. Bots will also be given points based on whether they disabled their opponent or forced their opponent off the battle area surface.
3. The two teams with the most points after the first-round battles in their pod will move on to the single elimination tournament.
4. Teams will be randomly matched to begin the single elimination tournament.
5. During the single elimination tournament, a robot that disables their opponent or is the last robot remaining on the battle area surface, will automatically win their match. A robot is considered disabled if they cannot control movement. Judges will notify team they need to show movement and if the team cannot, the judge will begin a 10 second countdown. If at the end of 10 seconds the team cannot control movement their robot is considered disabled and the battle over.
6. If neither robot is disabled or falls out of bounds, then the match will be determined by the best score in the same scoring categories as the first round. The team with the most points wins the battle.

SCORING CRITERIA:

1. During all battles, all robots will be scored on a scale of 0-5 in the following categories:

	5	4	3	2	1	0
Damage	massive cosmetic and functional damage done to opponent	massive cosmetic damage and/or significant functional damage	significant cosmetic damage and/or moderate functional damage	moderate cosmetic damage and/or minimal functional damage	Minimal cosmetic damage	No Damage done to opponent
Durability	Team's robot sustained no damage	sustained minimal cosmetic damage	sustained moderate cosmetic damage and/or minimal functional damage	sustained significant cosmetic damage and/or moderate functional damage	sustained massive cosmetic damage and/or significant functional damage	Team's robot sustained massive cosmetic and functional damage
Aggression	aggressively engaged opponent and consistently initiated contact	aggressively engaged opponent and initiated some contact	actively engaged opponent and actively engaged contact	actively engaged opponent and did not avoid contact	made some effort to engage with opponent but mostly avoided contact	made no effort to engage with opponent in combat, actively avoided contact
Control	exhibits expert control of robot and effective strategic choice in movement	exhibits advanced control of robot and strategic choice in movements	exhibits basic control of robot and some strategic choice in movements	exhibits basic control of robot	showed some ability to control robot	showed no ability to control robot

2. Awards will be given for 1st through 4th place.
3. 3rd and 4th place will be determined by scores in semi-final round
4. Other recognition may assigned at judges' discretion.

School: _____

Students: _____

For Official Use Only

- | Specification Check | Pass <input type="checkbox"/> | Fail <input type="checkbox"/> |
|--|--|--------------------------------------|
| 1. Team arrived on time for spec check and impounding | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 2. Robot meets 30 cm x 30 cm x 30 cm max size restriction | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 3. Robot meets 450 gram max weight requirement | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 4. Robot is not a pre-manufactured robot or build wholly from a robot kit | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 5. Does robot have a light to indicate power is on and systems are active? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 6. Does robot meet limitations on spinning weapons? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 7. Does robot meet limitations on excessively destructive weapons? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 8. Does robot have easily visible and controlled mobility? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 9. Does robot meet control and battery requirements? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 10. Is robot free of any forbidden weapons and materials? | If the answer is No for any of the above checks, the team is disqualified | |

	Match 1	Match 2	Match 3	Match 4	Match 5
Damage					
Durability					
Aggression					
Control					
Total					

Judge's signature: _____

Student signature: _____

Comments:

Poster Rubric

Category	Excellent (3 points)	Met Criteria (2 points)	Poor (1 point)	Not Present (0 points)
Project Overview - team summarizes the project, including team objective(s), successes, challenges, and performance expectation				
Bot Graphic – Team has a graphic of their MAKER bot				
Weapon Graphic – Team has a graphic of their weapon				
Weapon Description – The team has a bulleted list of how their weapon functions				
Testing Data 1 – Team has a graphic of testing data that helped determine their design decisions				
Testing Data 2 – Team has a 2 nd graphic of testing data that helped determine their design decisions				
Launcher Name			Yes	No
School & Team Member Names			Yes	No
School Logo			Yes	No
MESA Logo			Yes	No
Column Totals				