

University at Buffalo Student Association Battle Bots Official Rulebook

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Design Rules

Robot size & geometry

1. The maximum weight of a bot is 50 lbs.
 - a. Robots will be weighed in fighting conditions which includes ALL batteries and circuitry. To ensure this rule is followed, see *Match Rules 1a*.
2. The maximum dimensions of a bot shall not exceed 48 inches, and the combined length of three sides shall not exceed 88 inches.
 - a. Expansion to a greater size once combat has begun is permitted.
 - b. Robots that expand (or separate into multi-bots) after each match has begun do not need to be able to return to their original smaller state by themselves.
 - c. Multi-bots must start the match as one unit (i.e. the total space that they occupy must be within the maximum dimensions listed above).

Weapons

1. Judges may disqualify robots at any time if they deem them to be of danger to bystanders or participants.
2. Weapons that could harm a person while outside the arena must use a mechanical locking device to eliminate the possibility of accidental activation.
3. Approved Weapons:
 - a. Tethered projectiles (limited to 3 feet range, including the length of the tethered projectile)
 - b. High-inertia devices (i.e. flywheels or flails)
 - c. Carbide or abrasive blades
 - d. Impaling weapons (spikes, nails, etc.)
 - e. Permanent Magnets will be allowed (no electromagnets)
4. See the Engineering Coordinator if other weapons are being considered d. Banned Weapons:
 - a. Any kind of flammable liquid
 - b. Water for use as weapon
 - c. Flame-based weapons
 - d. Any kind of explosive or intentionally ignited solid
 - e. Radio jamming, tasers, tesla coils, or any other high-voltage device
 - f. Electro-Magnetic weapons
 - g. Un-tethered projectiles
 - h. Chemical (e.g. corrosive, cryogenic)
 - i. Compressed air or other gases (some exceptions may be granted)

Robot Controls

1. Robots must be radio-controlled.
1. Fully Autonomous robots are not permitted.
2. Radio antenna, if nonstructural and not part of a weapon system, do not count against the robot's size restriction.
3. All teams must pre-register their crystal frequency with the Engineering Coordinator prior to the competition.
1. Registration will occur on a first come-first serve basis, so reserve your frequency as soon as possible.

2. If two competing robots are operating on the same frequency, the match will be declared over, and the first team that properly registered their frequency will win.
3. Additionally, if a team not involved in the current match interferes with the match by operating their controller in the pits, the interfering team will immediately be disqualified.
4. In the event of dual usage on 'open band' ISM frequencies (900 Mhz, 2.4 GHz, 5 Ghz, etc), the groups must demonstrate that their systems do not cause interference with all similar frequency systems.
5. The Engineering Coordinator, after assembling the list of applicable frequencies, shall set up a testing time for this instance.
1. The Engineering Coordinator *may* implement an emergency cutout system. In this case, they shall be provided at minimum 2 weeks prior to the competition.
 - i. This system shall be capable of supporting a 55 Volt 330 Amp system. All bots must be wired to accept this.
 - ii. If the bot's power is over this value, then the team must integrate a safety cutoff circuit, to be approved by the Engineering Coordinator.
 - iii. The safety cutout system must be wired to disconnect both the drive and any weapon systems.
 - iv. In the event of a non-electric weapon, the safety system must cut out the control system in a way which does not cause the weapon to engage and serves as a lockout for the system.

Overall Robot Cost

1. The total cost of a team robot shall not exceed \$700. However, for a robot to enter the competition with a zero-point balance, the total cost must not exceed a base cost of \$500.
 - a. For a bot costing more than \$500, points will be added for every extra \$10 spent. Excess costs will be rounded up to the nearest \$10 mark, and 3 points will be added for every \$10 i.e. a bot with an overall cost of \$564 will be given 7 x 3 points = 21 points going into the competition.
2. All receipts for the materials used in the robot's construction must be made available during inspection.
 - a. Any components used in the bot will be evaluated at their base price or MSRP i.e. a "used" motor controller that originally costs \$100 in "new" condition, will account towards \$100 in the overall budget, even if it was purchased at \$30.
3. Recycled materials which are being used in the construction of the robot shall be included in the total cost of the robot.
 - a. Estimate as closely as possible for the reuse of materials.
 - b. Documentation supporting the estimated cost of the materials must be made available during inspection.
4. Components from previous years' bots shall be included in the total cost of the bot, with the original cost of the part being the value that counts towards the total cost.
 - i. This shall not include parts donated from previous years, which shall fall under donations as stated below.
5. An itemized list of bot parts is required and should be handed to the judges during inspection. It is recommended that this list be split up by system in the bot, ex: weapon system, drivetrain, etc...
6. All parts of the robot must be visible to the judges. Last-minute assembly can be done in

the inspection area. Close observation will be made to the clubs' final assembly to ensure that additional parts are not added in the process.

7. It is at the discretion of the judges to disqualify any robot that seems to exceed the cost cap of \$700.
8. Once the inspection is complete, the robot may not leave the inspection area until the time of competition.

Donations

1. Clubs are encouraged to seek donations from companies. Donated parts can be applied to the robot and do not count towards the total cost.
 - a. **Any club wishing to obtain donated materials or funds must first receive approval from the University Advancement office. Visit the "Funding Opportunities for Student Clubs" webpage or contact Nick Lane (nmlane2@buffalo.edu) to make sure SEAS policies are not violated.**
 - b. All donations must be accompanied by an authentic letter/receipt from the company stating that the part was donated.
 - c. All donations must be included in the itemized list, which is stated in **Overall Robot Cost**
 - i. Clubs can only accept monetary donations from alumni, NOT goods or materials. A limit of \$200 worth of donated materials shall be enforced for each bot.
 - ii. If a total value of over \$200 is donated, the surplus amount shall count towards the budget limit.

If \$250 worth of material is donated, then $\$250 - \$200 = \$50$ will count towards the total cost of the bot.

Robot Power

1. Batteries are to be used as a source of power.
 - a. Batteries must be sealed, immobilized-electrolyte types (such as gel cells, lithium, NiCads, or dry cells).
2. IC engines are not allowed due to the lack of positive ventilation around the arena.
3. Rocket engines are not allowed.

Miscellaneous

2. If a team has a questionable design, consult the Engineering Coordinator before constructing the robot, or at any time.
 - a. The Engineering Coordinator will make all final decisions on any matter.
 - b. There is a limit of two (2) robots that can be entered by a club, team, or individual but there is no limit to the number of controllers that are used.
 - c. The robot that is entered by a club in the bot wars competition must be the same as the one used in the maze competition.
 - d. Entering multiple robots is encouraged to promote competition, and clubs that enter multiple robots can be assured that their robots will start the competition on opposite ends of the tournament bracket or as far apart as feasible.
 - i. Teams will only be allowed to place once in the overall competition no matter how many robots a team enters. The team will place according to their highest placing robot, and the remaining teams will rank accordingly.

- e. After 4 years of competition, the robot must display significant changes. Photo evidence of the previous year's robot will be required to prove there has been significant structural change.
 - i. This is up to the digression of the judges. The beginning of the 4-year mark shall be the 2018 competition, requiring changes by the 2022 competition.
- f. If a team purchases an off-the-shelf robot (e.g. toy RC car), at least two modifications must be made to it.
 - i. This can include adding weapons, changing its motors or power source, etc.
 - ii. The Engineering Coordinator has final say on what counts as an acceptable modification.

Check-in Rules

Safety Inspection

1. All robots are required to pass a safety inspection before competing.
 - a. All operating principles must be clearly explained and demonstrated to the judges during this inspection.
 - b. This inspection will verify that Design Rules 2 - 6 are met, including that the proper reserved crystals/frequencies are being used.
2. Robots do not have to pass a test to prove that they can function, and non-functioning robots can choose to compete or to forfeit their match at the appropriate time.
3. A pit area will be provided for teams to use to prepare their robot.
 - a. Testing of robots in the pit area is **not permitted** and will lead to **immediate disqualification** of the offending team.
 - b. A testing zone may be provided on the day of the competition. Bots may only be in the powered and on state within this zone, or rule 2.a shall apply.
4. During check-in, the Engineering Coordinator will seed the entries in a random format (exception - see Check-in Rules 3.a) and will form a single or double elimination-type bracket for the event. This bracket will then be displayed on a large poster-sized paper and/or screen and posted in plain view as soon as possible during the event.
 - a. As stated in Design Rule 7e, clubs that enter more than one robot will be automatically placed on opposite sides of the bracket.
 - b. The losers of the semifinal match will compete for 3rd place in an additional match immediately prior to the Championship match.
5. After the first round, continuing competitors will have an allotted time available to test their robot away from the Student Union. Clubs that do not return to the check-in station at the allotted time prior to round two will be disqualified.

Match Rules

Pre-Check-In

1. The evening prior to the competition, there may be a check-in where each competitor shall be required to be weighed and safety verified. Teams may still weigh in additional bots the day of the event, however, at least one bot must be checked in the night before to qualify the club or organization for the competition.
 - a. The occurrence of this pre-check-in is at the discretion of the Engineering Coordinator and will be communicated at least one week prior to the competition. In the event the coordinator chooses not to hold the pre-check-in, check-in will occur the morning of the competition.

Pre-Match Weigh-in

2. Immediately prior to the competition, both teams must have their robots weighed and dimensioned at the judge's table. This is to ensure that Design Rule 1 is followed completely.
 - a. If part changes are made between matches, teams will be required to be checked in again.
 - b. Robots that expand outside the permitted dimensions will be inspected before every match to make sure that they are within the proper dimensions when the match starts.
 - c. Matches will be scheduled in 15-minute intervals \pm 5 minutes depending on the flow of the tournament. If a robot is deemed too heavy or big at its pre-fight weigh-in, the match will be delayed by one match and will switch timeslots with the next match on the list.
 - i. However, if the team cannot get their robot in fighting condition in time for the following match, they will be disqualified.
 - ii. If the match cannot be postponed because there are no more matches to switch with, then the team will have a maximum of 10 minutes to get their robot in fighting condition.
 - iii. If the robot is not ready within the allowed time, a penalty of 5 added points per minute will be assessed to the team.
 - d. Bots that have been slotted to enter a back-to-back competition shall be granted an additional 5 minutes of time before being required to re-enter the arena for their match.

Arena

3. The arena shall be of the same type and dimension as in years past: Plexiglas siding, painted wooden floor, and obstacles around the edges.
 - a. Any modifications to the arena will be communicated at least one month prior to the event.
 - e. It is expected that the arena surface may become damaged during the competition. Plan your robot's drive system accordingly. Being hung up on a damaged or irregular spot in the arena will count as "getting stuck" (see scorecard).
 - f. Competing robots must always remain inside the arena.
 - g. There will be two designated spots in the front row of the viewing area where contestants that are currently competing can stand to operate their robot. Contestants that are not involved in the current match will be treated as regular bystanders.

Combat

2. Each match will be a **STRICT 4 minutes in duration** and the Engineering Coordinator (serving as the Head Referee) will be the official timekeeper.

3. Robots compete head-to-head. Each robot will be placed in opposite corners of the arena at the start of the match.
4. The objective of each robot is to disable the opponent and to gain points as outlined by the judge's scorecard.
5. At the start of a combat round, all electric motors must be stopped. Any exposed rotating devices must be stationary.
 - a. This includes weapons. If a weapon is activated before the match starts, the robot will automatically forfeit the round.
 - b. During combat, no part of the operator's body or their remote antenna or any other device may penetrate the arena's surfaces unless a restart has been called. Interfering with a combat under way is grounds for immediate disqualification.
 - c. If a kill does not occur before the match time is up, the judges will call the winner based on the results of the scorecards. Each judge will declare a winner and the robot with the most votes from the judges will be awarded the victory.
 - d. In the event of a tie, the match will proceed to successive 2-minute overtime sessions until a winner can be declared.
 - e. If overtime is required to determine a match, clubs will *not* be allowed to change their robot's battery source.

Scoring

1. Scoring will follow the judge's scorecard that is included on the last two pages of this document.
2. The judges reserve the right to declare a match over at any time. Their word is final.

Post-Match Judge Review

1. Immediately following each match, the robots that have just fought will be placed in front of the judges so that they can be looked over, and the extent of the damage can be determined.
 - a. Judges requesting to see inside the robots must be allowed to do so.
 - b. Scores will be tallied at this time and the winner of each match must be announced before the next match begins.

Melee

3. If time permits, all functioning robots will have the option of competing in a 4-minute melee following the championship match.
 1. All participating robots will be placed in the arena to battle simultaneously.
4. The winner is the last robot standing at the end of the 4 minutes as determined by the judges.
 1. No scorecards will be used for the melee, so the opinions of the judges will be final.

Maze

1. Each bot (not club) will have two opportunities to complete the maze. b. Time starts when the robot begins moving (even if it is outside of the maze) and ends when it completely crosses the finish line.
2. A 3 second penalty will be given for each wall impact (i.e. bot touching wood), except for the one wall with a ramp.
3. **WARNING: Purposeful damage to the maze course materials will result in immediate disqualification.**
4. If robot is disabled for more than 20 seconds, the trial will be declared DNF. f. Drivers must stay outside the perimeter of the maze.

5. Going over walls is prohibited, except for the wall with a ramp.
6. No do-overs.
7. The robot cannot be touched while in the maze.
8. Winners will be declared based on the fastest time for each club.
 - a. If a club has two robots, one in first and one in second, that club receives 1st place in the maze, and 2nd place goes to the next fastest club.
9. Ties will be broken by retri al until the winner is declared.

Refereeing/Judging Rules

Referees

1. The Engineering Coordinator will serve as the head referee and official timekeeper for the event and will be responsible for seeding the teams in the bracket prior to the matches.
2. Two additional referees will assist the Engineering Coordinator. One will stand with each of the competing teams to confirm things like when the robot is no longer responsive.

Judges

1. There will be at least three judges for the event who will be responsible for filling out scorecards during the match to determine the winners. Winners of each match will be announced before the next match begins and all discrepancies must be settled before the next match begins.
2. In the spirit of Engineers Week, judges must have an engineering or qualifying technical degree (physics, math, etc.) Judging positions should be filled by respected members of the engineering community (i.e. professors, local employers, and especially SEAS alumni).
3. Judges will be appointed by the Engineering Coordinator and must be available for the entire day's events.

MC

1. The MC for the event will be chosen by the Engineering Coordinator and will likely be an SA officer/personality.

Awards

1. Five awards will be given throughout the course of the day: 3rd place, 2nd place, 1st place, melee winner, and “most creative”.
2. 3rd place, 2nd place, and 1st place awards will also be given to the clubs that compete in the maze portion of the competition.
3. Awards will be given immediately following the competitions.
4. A club’s performance in Bot Wars counts heavily toward E-Week champion, and to some extent, Engineering Club of the Year.

University at Buffalo Bot Wars Competition

Judge's Scorecard

Match _____ Team _____ Robot Description _____

Points Occurrence Total

Malfunctions

- Smoke/flames are emanating from **this robot** +20 x = + - Motor/Driving Malfunction (see **Driving**)
- Weapon Malfunction (see **Physical Damage**)

Flipped/Stuck* see next page for specifics on this section

- **This robot** has been flipped and is therefore immobilized +15 x = + (*Robots can be flipped by an opponent or by their own miss-efforts. No points will be assessed when a robot is flipped but can still move (i.e. double-sided robots).*)
- **This robot** is stuck and is therefore immobilized +5 x = + (*Robots can be pushed until stuck by an opponent or can become stuck by their own miss-efforts. Stuck is a temporary term which is different from a driving problem, and might be caused by a hazard, debris, or the arena floor.*)

Physical Damage (assessed during the match and confirmed afterward)

- Broken pieces, slices, cuts, significant dents to **this robot** +10 x = + (*Award points based on each occurrence, not each cut/dent. i.e. One hit that causes multiple dents is only one occurrence, but two separate hits that each cause one cut are each worth one occurrence*)
- The weapon of **this robot** is nonfunctional as the result of the match +10 x (1 max) = + (*i.e. saw blades that are bent/no longer spin, shattered cutting wheels, flails/bars that no longer spin, spikes that are broken off etc.*)

Driving

- Impaired drive motion of **this robot** +15 x (1 max) = + (*Due to physical damage or internal malfunction (i.e. a robot that can't seem to go where it wants to) - does not include mere bad driving by the operator*)
- Some inability of **this robot** to move/drive still functional +30 x (1 max) = + (*Drivetrain damage*)

Kill

1. Total inability of **this robot** to move/drive is nonfunctional.

Attacking

2. Winner by Knockout

- a. **This robot** was pushed by an opponent into the wall (clearly in control) +3 x = + _____
3. Striking (*no points will be assessed for striking that does not cause damage* (see **Physical**

Damage for point-worthy hits))**Over-Budget**

- ***This robot*** exceeds the base price of \$500 +3 x = +____ (*The value exceeding \$500 is to be rounded to the nearest \$10, and 3 points are to be added for each \$10 i.e. \$532 = 4 x 3 points = 12 points*)

Extra Point Reduction

1. The performance of ***this robot*** received outstanding applause/cheering -5 x (1 max) = - ____
 - a. If a robot has been flipped over or has become stuck, the attacker can call for a restart at any time and as many times as they want, or the attacker can continue to attack the helpless robot.
 - b. Additionally, each team has one “red flag” which they can throw at any time to call for a restart (i.e. when they are stuck, have been flipped, or are simply being mercilessly held in a corner and attacked).
 - c. Robots that become stuck to one another will need to be restarted, and no points will be assessed (it is likely, however, that points will be awarded in the Physical Damage category).
 - d. If both teams get stuck (unable to move for 30 seconds on own power and ability) independently and at the same time, points will be assessed as indicated in the Flipped/Stuck category, and each team will need to use their “red flag” if they want to be restarted.
 - e. If neither team has a “red flag” remaining when they each become stuck independently, then the match will be allowed one restart as determined by the event Referee.
 - f. The clock will stop from the point a restart is called to whenever the match resumes. Remember, getting stuck or flipped is temporary and is therefore not counted as a kill, even if the team has already used their “red flag”.