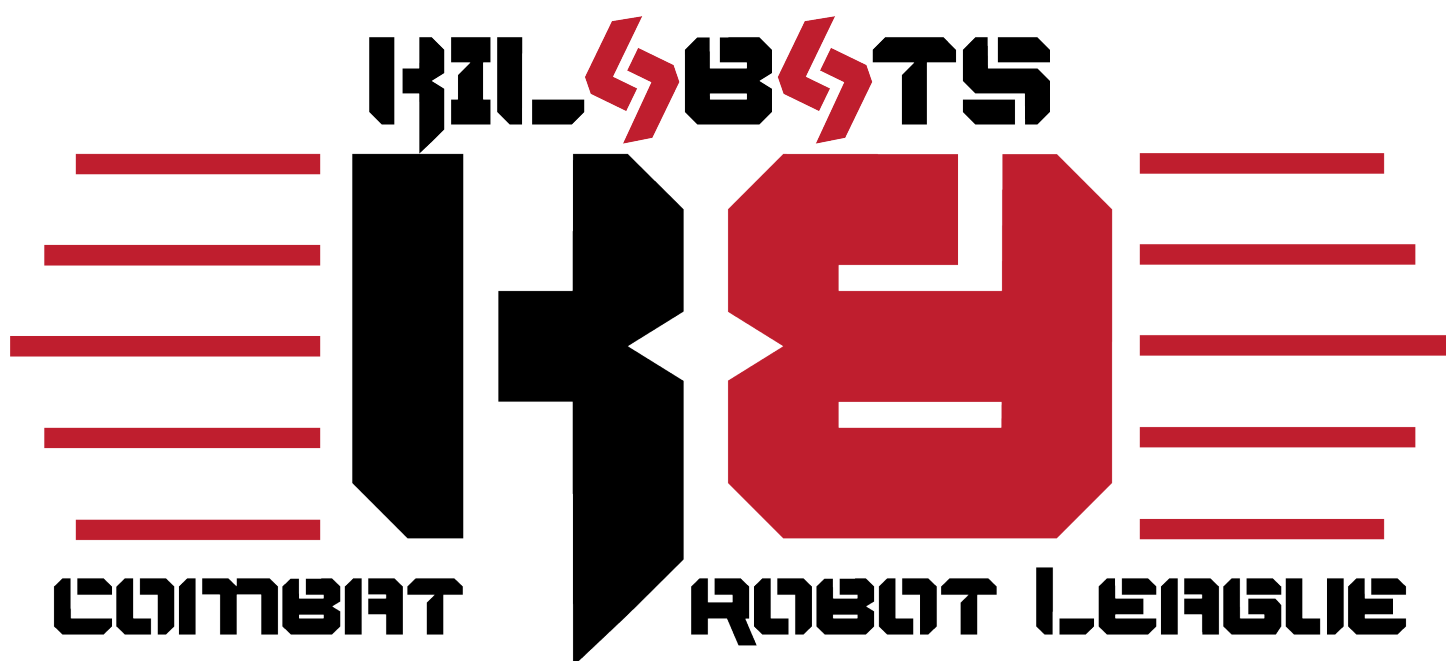




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OVERVIEW

Welcome to Kilobots!

Kilobots is a combat robot event in which two 3D-printed, radio-controlled robots will compete in a head-to-head match in which the goal is to incapacitate the other robot through a knockout. Robots that make it to the end of this intense three minute round will be judged by a group of three judges after which one robot will be declared the winner.

The General Idea

- Kilobots is a combat robot competition designed for Middle and High School teams.
- All robots should be designed, built, and operated by students.
- Robots will be primarily 3D printed.
- Robots are restricted to a maximum 1kg weight limit.
- Robots will compete in a 3 minute round in which either one of the robots is knocked out or the match time runs out.
- A panel of 3 judges decide the winner.
- Schools may enter multiple teams (robots) into the competition.

Competition Goals

Additive manufacturing (3D printing) technologies are being applied to everything from building houses, manufacturing rockets, medical applications, and even food production. There is no doubt that 3D printing is here to stay. Kilobots wanted to use this medium to give students more exposure to this technology and allow them to dive deeper into the creative ways it can be used. A few other reasons Kilobots focuses on primarily 3D printed robots are:

- Safety - primarily plastic robots make for a safer combat experience. (There are still dangers so, make sure to review the safety section.)
- Affordability - 3D printer filament is way cheaper than metals and other pricey materials.
- Ability to Iterate - By using additive manufacturing, students can quickly fabricate, test, and iterate on their design. This allows for more innovation and the ability to try multiple approaches.
- Accessibility - It's much easier to get going with a 3D printer than the equipment you need to work with metals and such.
- Customizability - Designing and printing robot components allows for more tailored and complex parts to be easily manufactured

Additionally, in order to be successful, students will need to draw from the fields of CAD, mechanical engineering, electrical engineering, and game theory all while learning to work together and think critically. We hope that Kilobots will not only be a lot of fun for students but will also open the door to possible future careers as well as build confidence and teamwork skills.

MATCH RULES

The following information provides the broad guidelines for team participation and match combat. See each additional section for more specific rules, requirements, and restrictions.

- All participants build and operate robots at their own risk. Combat robotics has inherent dangers that can lead to injury if safety procedures are not followed. There is no amount of regulation that can encompass every possible danger involved. Please take care to not hurt yourself or others when building, testing and competing. It is expected that adult supervision will be given to each student team and proper safety practices will be taught and used.
- If you have a robot or weapon design that does not fit within the categories set forth in these rules or is in some way ambiguous or borderline, please contact the organizers. Safe innovation is always encouraged, but surprising the event staff with your brilliant exploitation of a loophole may cause your robot to be disqualified before it ever competes.
- Compliance with all event rules is mandatory. While event officials will work to ensure safety, it is expected that competitors stay within the rules and procedures of their own accord.
- There will be safety inspectors at the tournament. It is at their sole discretion that your robot is allowed to compete. As a builder you are obligated to disclose all operating principles and potential dangers to the inspection staff.

General Rules

- Student teams should scratch design and build their own robot. **No kits should be used or premade designs downloaded/printed.** It is the intent that students are challenged learn the skills required to design and fabricate their own robots.
- Robots will compete head to head in combat until one is incapacitated or the time runs out.
- Matches shall be 3 minutes long.
- Matches will be played on an 2.5meter x 2.5meter enclosed arena.
- Combatants will be guaranteed no less than 20 minutes to prepare for the next match. In extreme cases the 20 minute time period may be lengthened at the discretion of the event organizers.

A robot loses a match when one of the following occurs:

- The robot is knocked out or cannot show sufficient mobility as defined below.
- The driver of the robot surrenders.
- A robot that is deemed unsafe by Tournament Officials after the match has begun will be disqualified and therefore declared the loser by TKO.
- Any robot which attacks or hits an opponent after the match has been declared over, may be disqualified and lose the match at the sole discretion of the referee.
- The robot is unable to drive from the box entry to its respective match box. If a robot is unable to drive to its box it will be considered disqualified and the other team awarded a KO. If neither team can drive to its respective box then the judges will determine the robot they believe has the best chance of advancing in the tournament and will award the match to that robot.
- All other matches will be decided by judges' decision. Judges' decisions are final.
- If a robot's battery becomes exposed during combat in a way the judges determine is a hazard, the robot will be declared loser by TKO.

Knock-out

- The referee will declare a knock-out when the robot does not show any controlled transitional movement. This begins after the opponent has ceased attacking for 5 seconds and fails to show controlled, transitional movement on request by the Referee.
- The robot will be issued a 10 second countdown.
- If the robot continues to be unable to show controlled, transitional movement and the opponent still does not attack, then at the end of the 10 second countdown the robot will be issued a loss by KO.
- Any attack by the opponent, or controlled transitional movement of the Robot will reset the time for this determination.
- Movement is "controlled" if the driver of the robot can move the robot across the arena floor.
- Orbiting a fixed location on the floor does not constitute "controlled transitional movement". The referee shall decide if movement is "controlled".

Incapacitation

- Robots may not win by pinning or lifting their opponents. Pinning and/or lifting will be allowed for a maximum of 15 seconds per pin/lift then referees will instruct the attacker to release the pinned/lifted opponent.
- An attacker that does not stop a pin or lift when requested by the Official may be deemed the match loser at the sole discretion of the referee, unless the two robots are stuck together.
- Keeping an opponent trapped in a corner shall be considered a pin, even if the attacker is not in continuous contact with the cornered opponent.
- If an opponent is held pinned (or cornered), the attacker must move far enough away after releasing the opponent so that the opponent has an opportunity to escape. When this happens the pinned/cornered robot is to be considered released and the pin timer stopped.
- A robot may be intentionally stranded by its opponent on an arena feature (floor seam, arena bumper or wall, etc.) Stranded robots have 5 seconds to free themselves, after which time they shall be given a 10 second countdown and issued a loss by TKO.
- The corners of the game field will be out of bounds and will be designated with a boundary wall. Robots knocked over the wall into the dead-zone will have 10 seconds to return to the field.
- Matches will be paused to separate robots in the event that they become stuck together in the arena and cannot separate from each other after 5 seconds.

Surrender/Forfeit

- Should a Combatant determine their robot is damaged to the point they wish to end the match, they will notify the Tournament Official of their intent. At that point the Official will ask the Combatant to confirm he/she wishes to end the match. If the Combatant says "Yes", the Official shall instruct the opponent to cease attacking and back away from the Combatant's robot. The Combatant tapping out will be deemed the loser and a win will be awarded to the attacker by TKO.
- Should a combatant forfeit or be disqualified prior to the beginning of a match, their opponent shall be awarded a win.

Power of Officials

Combatants must follow the instructions of Tournament Officials at all times. This is necessary to maintain the safety of everyone at the tournament. Circumstances beyond the scope of these rules and guidelines shall be up to the Officials' decisions. All Officials' decisions are final.

ROBOT REQUIREMENTS & CONSTRAINTS

Robot Materials and Requirements

- Teams may enter a single robot (no side bots) weighing no more than 1kg. (Not including remote).
- All entries must be accompanied by technical documentation. (See Required Technical Documentation.)
- The robot entered to compete must be the original robot registered (the same design and configuration) matching that robot's technical documentation.
- Robot parts must be primarily manufactured through 3D printing and only using the approved plastic filaments.
- The only approved plastic filaments that can be used for the chassis and weapons are: PET, PETG, PECT, ABS, PLA, PLA+, PEBA, and TPU. No other types of plastics, fiber filled, or other materials are allowed (ie. metal, carbon fiber infused, nylon, etc).
- A robot may be disqualified at the event organizer's discretion if it is deemed that it violates the spirit of the class. Contact the event organizers ahead of time if you are not sure your robot meets the above criteria.
- Teams are responsible for acquiring or purchasing all needed equipment and electronics for their robots.
- Robots must have an easily accessible, manually operated, mechanical method of disconnecting the main battery power, such as a switch that can be actuated in under 10 seconds while the robot is placed securely on the arena floor. (You may have a switch that requires inserting a hex key or such to activate it.)
- Electronics and internal components must be easily accessible for the safety inspection.
- Jumping or flying robots are not allowed.
- Robots must have an externally visible light to indicate when they are activated.

Non-3D Printed Parts

- While the competition focuses primarily on the use of manufacturing a combat robot through the process of digitally designing and 3D printing the majority of the robot, there are some non-3D printed components allowed. These are for the sake of practicality.
- Motors, batteries, esc's, receivers, micro controllers, wires, connectors, and other utilized electronic components are allowed.
- A total of two **carbon-fiber or plastic (NOT-METAL)** axels can be used for their intended purpose but neither should exceed **6mm in diameter and 35mm in length**.

- A total of two ball bearings can be used for their **intended purpose** [reduce friction for a spinning component] but **should not exceed 20mm in outer diameter and 8mm in thickness.**
- A total of two rubber bands may be used as a source of elastic potential energy. (See Weapon Restrictions about loading and failing to safe.)
- Metal fasteners (screws and grommets) and brass inserts can be used for their intended purpose. Fasteners may not exceed **5mm in diameter or 20mm in length.**
- A total of three nylon belts may be used for the purpose of transferring motion
- Foam or rubber is allowed for use on wheels to aid in providing traction. Wheel hubs should still follow 3D printing guidelines. (If a rubber band is used to provide traction, you will still be allowed the two bands to be used for potential energy sources.)
- Double sided tape, velcro, or zip ties may be used to secure electronics in place or wire management only.
- No non-3D printed part may be used outside its intended purpose or in such a way as to enhance structural integrity, armor the robot, or enhance any weapon.
- ****A NOTE ABOUT MOTORS & ADAPTERS****
 - **Metal motor adapters are not allowed (even those that come with a motor).** Please consider this when choosing your motor. It is recommended you purchase motors with threaded shafts or shafts with a flat side allowing for a set screw.
 - Brass Inserts may be used with a threaded motor shaft to connect motors to plastic parts.
 - Just like other fasteners, metal set-screws may be used to secure parts to shafts.

Robot Control

- Tethered control of robots is not allowed.
- Radio systems that stop all motion in the robot (drive and weapons), when the transmitter loses power or signal, are required for all robots with active weapons.
- All robots must use a spread spectrum radio system with digitally coded, mated pairs between transmitter and receiver. This means that no other transmitter, operating on the same frequency, can communicate with your receiver, and your transmitter cannot send signals to any receiver other than your own. (Some examples are: Spektrum, IFI, XPS XtremeLink, etc.)
- No home built or Toy radio systems are allowed at this event for any robots.
- Up to two operators (or a driver and a spotter) will be allowed in the operator zone during a match.
- Robots may only be powered on and/or tested when in the approved event safety zone.
- All transmitters must remain turned off except at places or times when event officials have given clearance to activate.

Weapons

- Robots may have one primary weapon such as a lifting, flipping, or spinning weapon.
- Rotational weapons or full body spinning robots are allowed.
- Spinning weapons must be able to come to a full stop within 60 seconds of the power being removed.

- All active weapons must have a removable safety locking device that keeps the weapon from moving when in place. (Example: a metal rod that locks a spinning drum in place and can be removed before a match.)

Weapon Restrictions

- Any elastic bands used for drive or weapon power must have a way of loading and actuating the spring remotely under the robots power.
- All weapons must fail to a safe position (in the event of a signal loss will stop functioning).
- No pneumatic or hydraulic weapons.
- No drilling or flammable weapons of any kind.
- Electrical weapons.
- RF jamming equipment, etc.
- EMF fields from permanent or electro-magnets that affect another robots electronics.
- Nets, tapes, strings, and other entanglement devices.
- Liquid weapons.
- Foams and liquefied gasses.
- Powders, sand, ball bearings and other dry chaff weapons
- Un-tethered or tethered Projectiles.
- Explosives or flammable solids.
- Light and smoke based weapons that impair the viewing of robots by an Entrant, Judge, Official, or Viewer.

Power Requirements

- Robots must be powered by a single rechargeable power source.
- Allowed battery kinds are NiCd, NiMh, LiPo, LiFe, and Li-Ion.
- Maximum allowed voltage is 12v.

SEASON SAFETY GUIDELINES

- Safety of our students and all those involved is of the utmost importance.
- All students should be monitored throughout the season and constant adult supervision provided.
- For testing outside of tournaments, teams should have their own fully enclosed, safe area if to test their robot prior to the event. This testing enclosure should protect people from flying debris, fumes, and other possible dangers.
- Proper safety standards should be taught and PPE used when applicable.
- Each team should create an established team safety procedures document that can be available on request by safety inspectors.

- All participants must wear eye protection when in the pits or operating robots.
- A testing box will be provided at the event and used for testing and safety inspections.
- No bots shall be operated outside the event testing area.

TOURNAMENT PROCEDURES

In order to have a safe and efficient tournament, we have established the following procedures. This section should be reviewed prior to attending the match in order to ensure all teams are able to participate and enjoy the event.

Tournament Format

The Kilobots Combat Robot tournament will be a double elimination style tournament. Each robot team is guaranteed two matches. However, teams that go all the way to finals will compete in up to 8 matches. Participants should plan accordingly.

Awards

The following awards will be awarded at the Championship Tournament. Lead up events may feature some or all of these awards. Event organizers will publicize awarded categories ahead of the event. Awards will be presented in the following categories:

- 1st Place Tournament Champion
- 2nd Place Tournament Champion
- Creative Engineering Award - Given to the team judged to have the most innovative engineering features in their robot.
- Most Robust Robot - Given to the team whose robot can take a hit and keep coming back.
- Damage Dealer - Given to the team whose robot weapon can really dish it out.
- Puppet Master - Given to the team whose robot can take control in a match.
- Most Photogenic - Given to the team whose robot just looks cool.
- Best Robot Showcase Video - See rubric.
- Best Technical Documentation - See rubric.
- Best Team Interactive Station - Given to a single school/organization. See rubric.

Safety Inspection

All robots will be subject to a thorough safety inspection before being allowed to compete in a match to ensure the safety of participants, spectators, and judges. Please review the safety checklist for all requirements.

Match Participation

- Match participants will check in before each match for a cursory inspection and weight check.

- Robot weapons should be secured and robots powered down until entering the battle box.
- Load-In procedures will be followed.
- Operators (1-2 per team) will go to their respective operator boxes.
- Operators will drive their bot from the entry to their respective box.
- Operators will have 10 seconds to test the operation of their robot (no contact can be made with the opponent during this time) and they will drive to the starting box.
- Operators will be asked if they are ready. When both have affirmed, the match countdown will begin.
- A 3 beat countdown will begin and when the buzzer sounds, the match begins.
- During the match, all judges instructions should be followed.
- At the end of a match (KO or 3 minutes), load-out procedures will be followed.
- Teams may then return to their pit stations with their robot.
- Teams will have a minimum of 20minutes between matches to make repairs.

Load In Procedures

The combat area is defined as the region of the arena where active combat occurs. This would exclude gutters between whatever internal barricade exists in the arena and the arena walls.

Priority for load in is as follows:

- Least dangerous bot being activated by someone inside the combat area
- Most dangerous bot being activated by someone inside the combat area

The process for activating a robot is as follows:

- Robot is placed in a stable position on the combat area with the drive wheels oriented such that when they come in contact with the combat area the direction of travel will be away from other robots, persons, and entry doors. If the robot has a directional weapon, it will be aimed at the wall furthest from the arena entry door.
- Weapon covers are removed.
- Transmitter is turned on.
- Main power is turned on.
- If separate, weapon power is turned on.
- Weapon locks are removed.
- If the robot is being activated by a person inside the combat area, they then exit the arena, otherwise the robot is driven to the starting square from their power on location.

Pre-Match Start Safety Procedures

- No movement or functional testing is permitted while anyone is in the combat area.

- Once both robots are activated and in their starting squares the arena access point will be closed and a maximum of 10 seconds will be allowed for a brief weapon/drive system test if the drivers so desire.
- No weapon testing of any sort will be allowed prior to the arena door being closed.

Load Out Procedures

At the end of the fight both robots are to cease movement and, if applicable, allow their weapon systems to de-energize. Once the weapon systems have been de-energized the judges may request that one or both robots demonstrate that either their drive or weapon system is still functional. Demonstration of weapon system functionality will be done by the robot returning to its starting location and briefly applying power to the weapon system to show that it is still operational. The robot will not spin to full speed during this demonstration. Once this is completed the robot deactivation and load out procedure can begin.

Priority for load out is as follows:

- Most dangerous bot being deactivated by someone outside the combat area
- Least dangerous bot being deactivated by someone outside the combat area

The process for deactivating a robot is as follows:

- Weapon system is disabled. This includes any applicable weapon locks, power cut-off, etc. The exact order of this procedure will be left to the discretion of the builder as differing designs may necessitate different safe shutdown procedures.
- Main power is turned off.
- Transmitter is turned off.
- Weapon safeties are reinstalled.
- Robots will be removed from the arena once all robots have had their weapon locks installed and are powered down.

Emergency Match Stoppage Procedure

In the event of an arena breach, damage to the arena that renders it unsafe, or any other event that is otherwise judged a safety risk by event staff the match shall immediately be halted.

If a competitor continues to fight after the referee has called for the fight to be stopped they will be disqualified. Repeated infractions will result in removal from the tournament. It is the responsibility of the driver to ensure that they respond promptly to the call to stop fighting.

Once fighting has ceased the robots will be deactivated. The deactivated robots may be left in place or moved to a safe location in or around the arena until a determination about the status of the fight is made. No work may be done on the bots during this time. The source of the safety issue will then be inspected to determine the appropriate action. Once the issue has been resolved a determination will be made as to whether or not the fight will resume. If possible, the fight will resume from the point where it was paused. If resuming the fight is determined to not be possible due to a safety concern or other issue the fight will be judged up until the point where it was stopped.

The safety of the crowd, competitors, and crew will always be considered when determining if any additional measures need to be taken beyond resolving the immediate safety issue.

Stickages

- Matches will be paused to separate robots in the event that they become stuck together in the arena.
- Robots that become stuck together will be allowed 5 seconds to attempt to separate.
- If they are not able to do so an un-stick will be called for by the referee.
- An un-stick can only be called for by referee.
- Safety officials will try to safely separate the robots.
- No modifications or repairs are allowed during an unstick.
- If robots are able to be safely separated within a reasonable amount of time, the match will resume from the point at which it was halted.

Weight Verification

- Robots will be weighed prior to each match.
- The time required to verify that the robot is still within the legal weight limit will not be counted against the robots guaranteed time between matches.
- In the event a robot is found to be over the weight limit they will not be allowed to participate in a match until made legal.
- Matches will not be delayed in order to wait for a team to make the robot weight legal.

Robot Modifications During The Event

Teams are expected to bring all needed replacement parts and equipment needed to repair their robot between matches. However:

- Teams are only allowed to bring **one** complete, assembled robot.
- Teams may bring replacements for every part of their robot including electronics, belts, fasteners, and 3D printed parts. However, no components may be either fully or partially pre-assembled.
- The robot entered to compete must be the original robot registered (the same base design and configuration) matching that robot's technical documentation.
- Reconfiguration of your robot is allowed (different armor configurations, weapon configurations, etc) but should remain as the same fundamental design entered and matching the original technical documentation. If a robot has a modular design, modular alterations are allowed if having been disclosed in the technical documentation. Any changes to the configuration of your robot must be disclosed to the judges/safety inspectors prior to your next match and may be subject to an additional safety inspection.
- Failure to disclose any reconfigurations may be grounds for disqualification from the match or tournament.

Participant Conduct

All participants are expected to conduct themselves in manner that promotes good will and a spirit of community. In order to achieve this, the following is not allowed:

- Crude or foul language
- Post combat contact
- Sabotage
- Distraction of opposing robot operators

- Blatant early movement, etc.

Participants who conduct themselves in a unsportsmanlike way will receive a penalty. Repeat offenses may result in match or tournament disqualification.

JUDGING GUIDELINES

In the event that both robots in a match remain functional to the end of the 3 minute match, a panel of 3 judges will determine the winner. Judges decisions are final.

Scoring Categories

Aggression (5 points possible)

Aggression scoring will be based on the relative amount of time each robot spends attacking the other. The primary means of scoring points in this category involves attempting to attack the opponent in a controlled manner, whether or not the attack is successful.

Control (6 points possible)

Control scoring will be based on the relative amount of time each robot spends in control of the fight. The primary means of scoring points in this category involves using elements of the robot or arena against the opponent in a manner that doesn't directly involve the weapon system of the robot causing damage. This would include utilizing any arena hazards as the use of active or passive weapon systems on an opponent that don't directly cause damage.

Damage (6 points possible)

Damage scoring will be based on the relative amount of damage dealt by each robot. The primary means of scoring points in this category involves doing non-cosmetic damage to the opposing robot. The severity of the damage done by each robot will be considered by the judges and used to determine the score.

Scoring Aggression (5 points possible)

Aggression scoring will be based on the relative amount of time each robot spends attacking the other. Attacks do not have to cause damage to count for aggression points, but a distinction will be made between chasing a fleeing opponent and randomly crashing around the arena. Points will not be awarded for aggression if a robot is completely uncontrollable or unable to do more than turn in place, even if it is trying to attack. Sitting still and waiting for your opponent to drive into your weapon does not count for aggression points, even if it is an amazingly destructive weapon. Robots must show translational movement toward their opponent for it to be counted as aggression.

- 5-0: a 5-0 score shall be awarded only when one of the robots never attempts to attack the other, and the other consistently attacks.
- 4-1: a score of 4-1 shall be awarded in the case of significant dominance of attacks by one robot, with the other only attempting to attack a few times during the match.
- 3-2: a 3-2 score shall be awarded when
 - Both robots consistently attack the other.
 - Both robots only attack the other for part of the match.
 - Both robots spend most of the match avoiding each other. In this case it will be up to the judge's discretion to decide which robot made more attempts to attack the other.

Scoring Control (6 Points Possible)

Control scoring will be based on the relative amount of time each robot spends in control of the fight.

The primary means of scoring points in this category involves using elements of the robot or arena against the opponent in a manner that doesn't directly involve the weapon system of the robot causing damage. This would include utilizing any arena hazards to cause damage to the opposing robot.

Examples of control include:

- A grabbing/lifting/wedge robot making guiding contact with the opposing robot and delivering them to an arena hazard or hitting them against the combat surface and/or arena walls.
 - Flipping over the opposing robot.
 - Immobilizing or otherwise stalling the opponents weapon.
 - A spinning robot being able to get its weapon to full speed.
 - Awarding Control Points
-
- 6-0: a 6-0 score shall be awarded only when one robot completely controls the momentum of the match. Examples of this would include:
 - A wedge or ramming robot preventing a spinning weapon from ever reaching full speed.
 - A grabber or crusher consistently grabbing and manipulating its opponent with little to no offense from the opponent.
 - A flipper reliably flipping its opponent without frequent missed flips.
 - A spinner being able to consistently and repeatedly get its weapon back to speed after hitting the opponent.
 - 5-1: a score of 5-1 shall be awarded in the case of significant dominance by one competitor. The competitor receiving 5 points should frequently exhibit the relevant behaviors noted in the control example section with only short periods of the opposing robot gaining the upper hand.
 - 4-2: a score of 4-2 shall be awarded in the case of slight dominance by one competitor. The competitor receiving 4 points should exhibit the relevant behaviors noted in the control example section for a clear majority of the match.
 - 3-3: a 3-3 score shall be awarded when both robots are either able to demonstrate control for a significant portion of the match or neither robot are able to reasonably demonstrate control during a match.

Scoring Damage (6 Points Possible)

Scoring of damage points is based on relative grading of each robot's damage.

- 6-0: a 6-0 score shall be awarded when:
 - One robot suffers nothing more than trivial damage, and the other is at least significantly damaged
 - One robot has suffered major or massive damage and the other is no more than cosmetically damaged.
- 5-1: a 5-1 score shall be awarded when:

- One robot suffers at least minor damage and the other suffers major or worse damage
- One robot has suffered cosmetic damage and the other has suffered at least significant damage.
- 4-2: a 4-2 score shall be awarded when:
 - Both robots have suffered nearly the same level of damage but one is slightly more damaged than the other
 - One robot has suffered trivial or cosmetic damage and the other has suffered minor damage
- 3-3: a 3-3 score shall be awarded when:
 - Both robots have suffered the same level of damage
 - Neither robot has even cosmetically damaged the other

*Damage that is self-inflicted by a robot's own systems and not directly or indirectly caused by contact with the other robot or an active arena hazard will not be counted against that robot for scoring purposes.

TEAM DELIVERABLES

Technical Documentation (Required for Tournament Participation)

Technical documentation is required for participation in the Kilobots combat tournament. It fulfills two main purposes. First, it provides compliance officials with a reference to review and certify robots for competition. Current and accurate documentation is essential for compliance; teams that fail to submit required documentation or provide inaccurate information will not be permitted to compete in tournament matches. Second, the process helps teams develop industry-relevant skills in documenting engineering work, deepening their understanding of their robot's design and the technology applied. Technical documentation must meet the following parameters:

- Printed and bound (stapled, 3-ring binder, etc.) on 8.5" x 11" paper.
- Have a cover page that includes:
 - Robot name, team name, school, and coach's name with a primary contact email.
 - Weight in grams (excluding the remote).
 - Short description of the robot's design and primary weapon (lifter, spinner, wedge, etc.).
- A Materials and Construction section (1–2 pages) that includes:
 - Description of all 3D-printed filament types used and, if multiple filament types are used, which parts are printed in which material.
 - Description of key print settings used (for example: layer height, number of walls, infill settings, etc.).
 - List of all non-3D-printed parts (motors, bearings, axles, belts, rubber bands, fasteners, foam/rubber, etc.) with counts and dimensions.
- A Design section (1–3 pages) that includes:
 - An exploded CAD view of the complete robot.
 - Labeled photos or diagrams showing the chassis, drive system, weapon, and armor.
 - Description and location of the main power switch or mechanical disconnect, including how it can be actuated in under 10 seconds.
 - Description and location of the weapon lock for active weapons.
 - Location and confirmation that the robot has a visible "robot on" light.
 - Description of the primary weapon type and how it works (including any elastic bands, belts, or spinning masses).
 - Explanation of how the weapon stops within 60 seconds of power removal and how it fails to a safe state on signal loss.

- An Electronics and Control section (1–2 pages) that includes:
 - Simple block diagram showing the battery, power switch, ESCs, receiver, drive and weapon motors, and any microcontrollers, with connections shown. (Example provided in the [Supplemental Materials Section](#).)
 - Battery type, capacity, and nominal voltage, confirming it does not exceed 12 volts.
 - Radio system brand/model, confirming it uses spread-spectrum, signal pairing technology.
- A Technical Safety section (1–2 pages) that includes:
 - Brief record of safety tests (power-off time for weapon, radio failsafe tests, power switch access test, and a “no loose parts” check).
 - Pre-match inspection checklist the team will use (tightening fasteners, verifying weapon lock, checking battery, etc.).

Robot Showcase Video (Optional)

Teams can create a short, high-energy “sizzle reel” that quickly grabs attention while showcasing their combat robot and team spirit. These videos will be shown to introduce their robot at the tournament and showcased on the website. The video should feel like a teaser or highlight reel, that shows off your robot (action shots, rotating shots, etc.) Videos will be judged on how well each video functions as a true sizzle reel (clear, dynamic, and engaging) while effectively communicating the robot’s capabilities and creativity.

Required video specs

- Length: 30-60 seconds total, including any titles and credits
- Showcases the actual robot (with multiple views and action shots)
- File Format: MP4, horizontal (16:9), at least 720p resolution
- Has Audio: Music and/or narration that is copyright-safe (original, royalty-free, or with permission)
- Identification: Must clearly show team name, robot name and the kilobots logo somewhere in the video (title card or overlay)
- See the [Video Judging Rubric](#) at the end of this document.

MISCELANEOUS

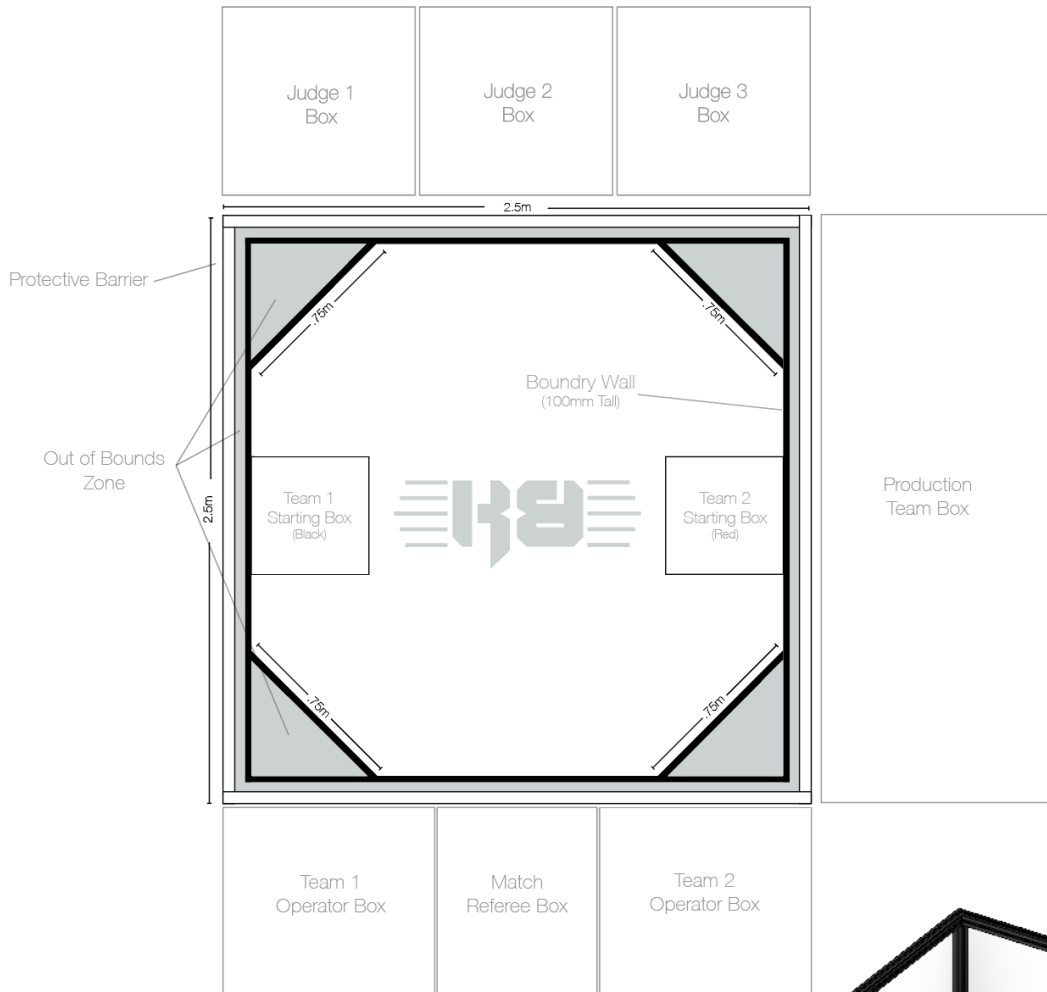
While we tried to be as thorough as possible and anticipate every conceivable situation, we know that there are certain lessons that can only be learned as we go. Our priorities for this event are safety, education, student empowerment, and fun. There may be decisions made in the course of this event based on unique situations. In doing so, these priorities will always be our guiding principles.

If you have any questions, please reach out to the event coordinators.

SUPPLEMENTAL MATERIALS

BATTLE BOX LAYOUT

The Battle Box is an elevated (.75m high) arena (2.5mx2.5m) with protective polycarbonate windows on all 4 sides (1.5m high). This is a planned illustration of the battle box for your reference. However, some details may be adjusted before competition.



SAFETY CHECKLIST

The following items will be required in order for your robot to pass the safety inspection and be allowed to compete in the event.

- ☐ Team provided technical documentation.
- ☐ Robot is no heavier than 1kg. (Not including controller.)
- ☐ Only allowed plastics used.
- ☐ All materials used in allowed ways. (Fasteners, adhesives, belts, etc.)
- ☐ Electronics use 12v maximum power.
- ☐ Has an easily accessible, manually operated, mechanical method of disconnecting the main battery power that can be actuated in under 10 seconds.
- ☐ Control system uses spread spectrum, signal pairing technology.
- ☐ All weapons fail to a safe position.
- ☐ Any active weapon has a locking safety to prevent accidental movement.
- ☐ Any sharp points on weapons or the robot have a safety cover.
- ☐ All requirements must be able to be demonstrated during the safety check.

Video Judging Rubric

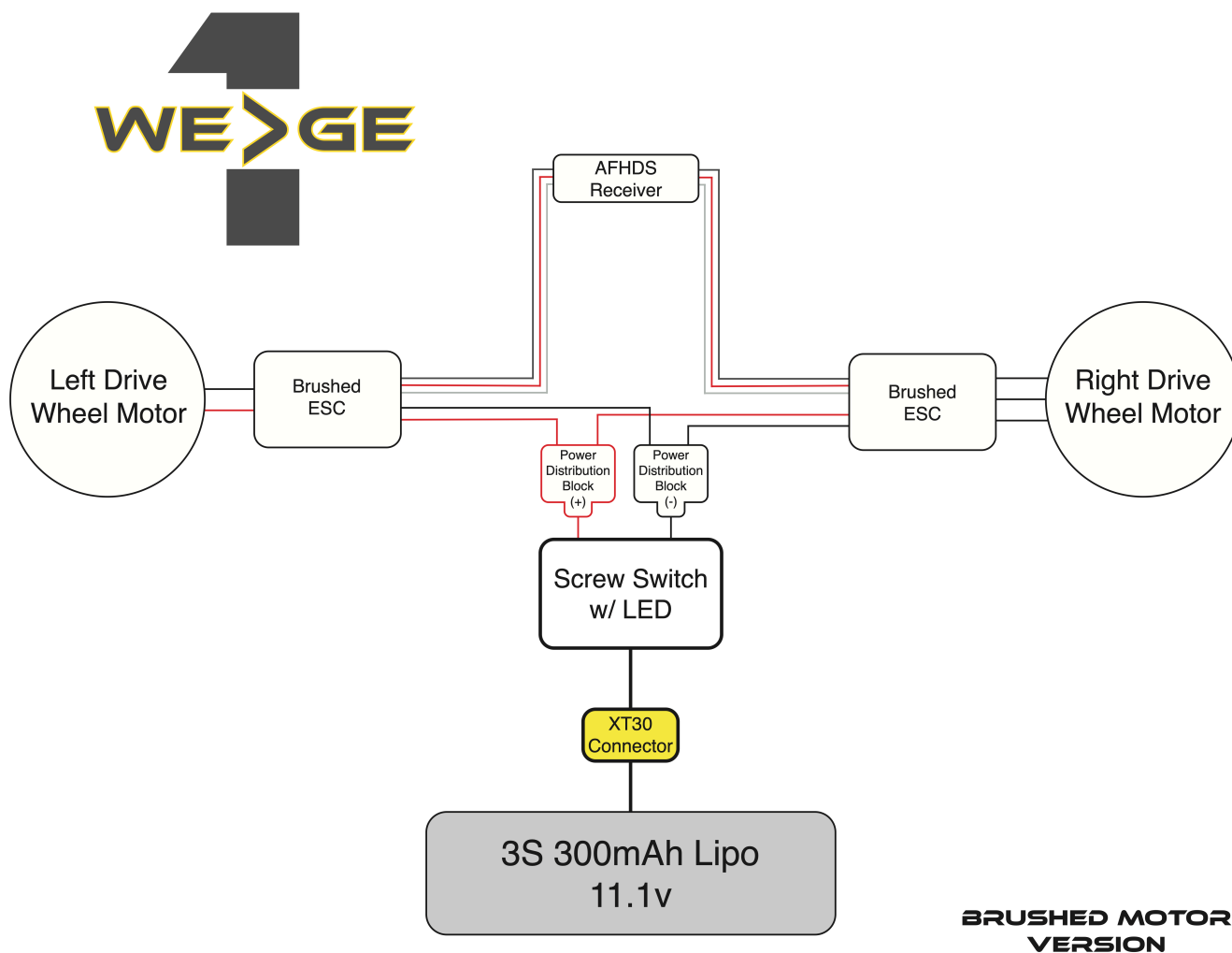
The following rubric will be used to evaluate videos.

Category	Criteria	Awarded
Clarity & Focus (25 pts)	0 - 9 pts: Robot is rarely visible or actions are unclear. 10 - 19 pts: Robot is visible and some functions are clear, but key mechanisms or weapon use are only partly shown. 20 - 25 pts: Robot is clearly shown performing its core functions; viewers can quickly understand what it does and why it's effective.	
Story and Structure (25 pts)	0 - 9 pts: Clips feel random; no clear beginning or end. 10 - 19 pts: Basic structure (intro and some conclusion) but pacing is uneven or includes filler. 20 - 25 pts: Clear intro, focused middle with action, and a satisfying end; video feels intentional and tells a mini story about the robot.	
Creativity and Style (25 pts)	0 - 9 pts: Very plain; little to no creative choices. 10 - 19 pts: Some creative elements (music choice, a few cool angles, simple text) but not consistent. 20 - 25 pts: Strong, consistent style (good use of angles, text callouts, timing with music, effects, or fun theme) that enhances the robot showcase.	
Technical Video Quality (25 pts)	0 - 9 pts: Poor lighting or focus; audio distracting; text hard to read. 10 - 19 pts: Generally watchable, with a few issues (shaky shot, brief bad audio, cluttered visuals). 20 - 25 pts: Clear image, good lighting, mostly steady shots, readable text, and audio that supports rather than distracts.	

EXAMPLE ACADEMY

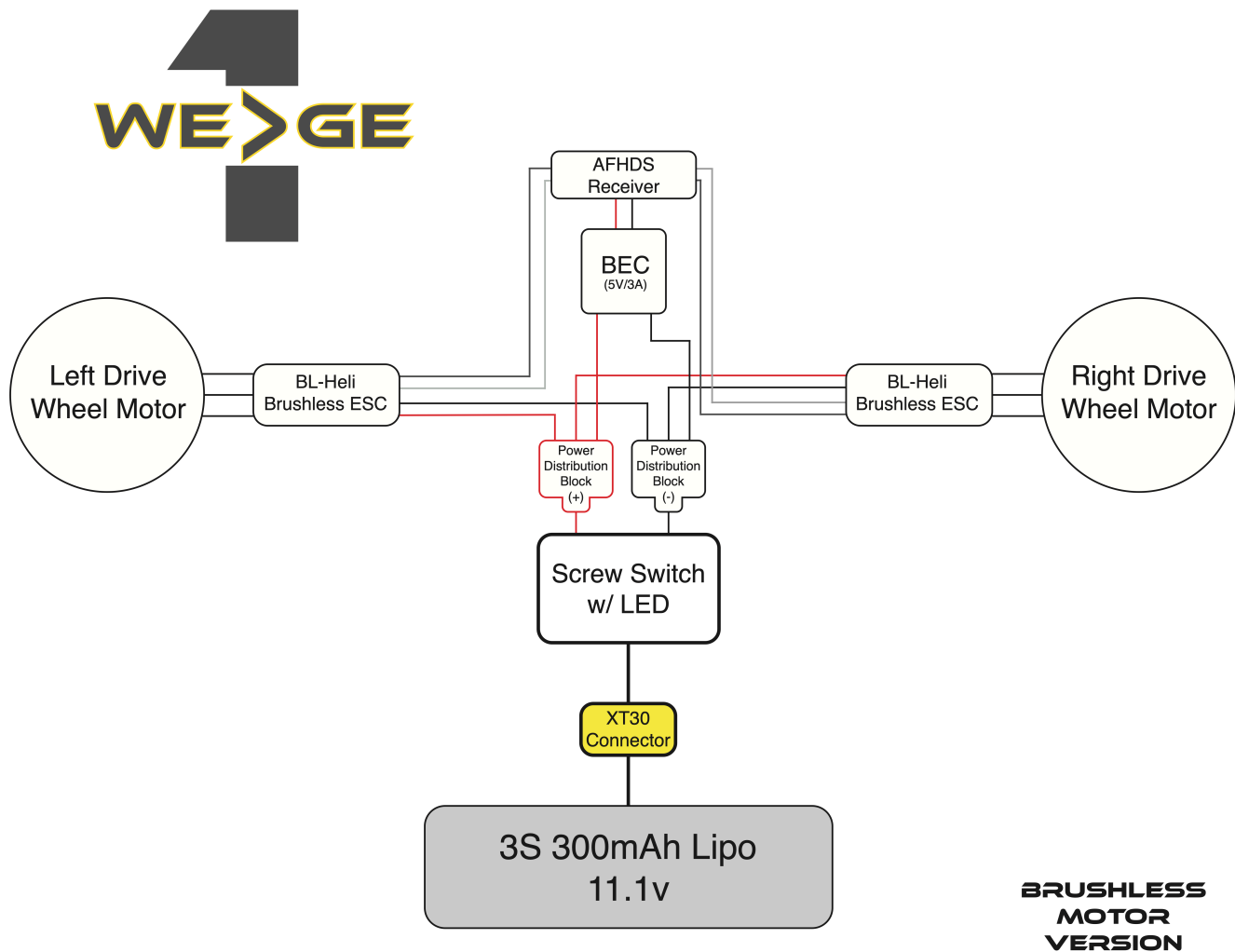
BLOCK DIAGRAM EXAMPLE 1

Description: The electrical system for a wedge robot with no active weapon that uses a **brushed** motor drive system.



BLOCK DIAGRAM EXAMPLE 2

Description: The electrical system for a wedge robot with no active weapon that uses a **brushless** motor drive system.



TEAM SAFETY PLAN EXAMPLE

It's a good idea to create an established safety plan for your team that includes safety training, best practices, procedures, tool risk assessment, etc. The following is an example plan you may want to adapt for your team.

SAFETY VIOLATIONS RECORDS AND RESPONSES

Overview:

All team members complete safety training and sign a contract (with a parent/guardian) agreeing to follow safety rules and informed of consequences of violations. Violations are considered the responsibility of the team member, and consequences must be accepted.

Guidelines:

- Students and adult supervisors are expected to maintain high safety standards at all times in engineering spaces and at competitions.
- Team leads are responsible for logging incidents and ensuring that corrective steps are taken.
- Safety sheets and logs serve as part of team compliance and preparedness documentation, essential for audits and competition entries.

Safety Steps:

- Any Violation - Record the Date, Member, Description, Step Response, Master, Offense, and Step Taken on the team safety record digital sheet.
- Inform a team adult mentor.
- Determine Next Step
- Offense (per individual violation):
 1. Verbal warning
 2. Retraining as needed with a team mentor
 3. Temporary Suspension from tool/activity related to violation
 4. Parent conference / team status potentially impacted

Assessment of Tools, Hazard Risks, & Potential Injuries

Assessment of Tools, Hazard Risks, & Potential Injuries

Tool	Hazards/Risks	Common Inj	Main Controls
Drill Press	Entanglement, pinch points, flying debris, sharp bits	Lacerations, eye injuries, entanglement, crushed fingers	Safety glasses, secure workpiece, avoid loose hair/clothes, use guards, no gloves/jewelry
CNC Machine	Entanglement, part ejection, unexpected motion, electrical hazards	Cuts, crush injuries, impact, electric shock	Interlocked guards, training, emergency stop, maintain enclosure, prohibit access during run
Band Saw	Blade contact, flying debris, entanglement, repetitive strain	Lacerations, amputations, eye injuries, strain	Blade guard close to work, push sticks, PPE, proper posture, tie back hair, inspect before use
Miter Saw	Blade contact, kickback, flying chips, noise exposure	Severe cuts, amputations, eye/face injuries, hearing loss	Blade guard, clamp material, eye & ear protection, proper hand placement, safe operating posture

Team Safety Plan

Safety Equipment Locations

- Fire Extinguisher: Outside shop door
- First Aid & Bleed Control Kits: First aid cabinet by shop door

EMERGENCY CONTACTS

Service	Phone Number	Notes
Fire/Police/Medical	911	Dial in any life-threatening emergency
Smyrna Fire Dept	615-459-9735	315 S Lowry St, Smyrna, TN 37167
Smyrna Police Dept	615-459-6644	Non-emergency line; for suspicious or criminal activity
Poison Control	1-800-222-1222	Tennessee Poison Center, 24/7 help
Local Hospital ER	615-768-2000	TriStar StoneCrest Medical Center, 200 Stonecrest Blvd

Team Safety Practices

- All team members are trained in emergency response protocols and know the location of all safety equipment.
- PPE (safety glasses, closed-toe shoes) is required at all times in the shop.
- Long hair must be tied back; avoid loose clothing and jewelry during machine use.
- Safety signage and emergency instructions are posted near the shop entrance and workstations.
- All incidents and injuries must be reported to the team supervisor/instructor immediately.

Emergency Procedures

- In case of fire: Evacuate immediately through marked exits, call 911, and use fire extinguisher if safe.
- In case of injury: Administer first aid (kits in cabinet by shop door), call 911 if injury is serious.
- In case of poisoning: Call Poison Control (1-800-222-1222); follow operator's guidance.
- Supervising instructor must be notified immediately in any emergency situation.