

# WyoBots Robot Construction Specifications

(adapted from the SPARC robot combat ruleset)

## 1. Ruleset

- 1.1. This document has been adapted for WyoBots 2019. Check to make sure that you have the latest revision of the ruleset. Contact [wcs\\_robotics@wyomingcityschools.org](mailto:wcs_robotics@wyomingcityschools.org) with questions.

## 2. Arena

- 2.1. The arena will be approximately 6ft x 6ft x 4ft. Make sure your robot can fit in a 1.5ft square, as larger robots may not be able to compete if they cannot fit through the arena door, contact event supervisors if you have questions about this.

## 3. General

- 3.1. All participants build and operate robots at their own risk. Combat robotics is inherently dangerous. There is no amount of regulation that can encompass all the dangers involved. Please take care to not hurt yourself or others when building, testing and competing.
- 3.2. 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 event organizer. 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.
- 3.3. Each event has safety inspections. 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.
- 3.4. Cardinal Safety Rules: Failure to comply with any of the following rules could result in expulsion or worse, injury and death.
  - 3.4.1. Radios that do not operate using spread spectrum technology may not be turned on at or near events for any purpose without obtaining the appropriate frequency clip or explicit permission from the event.
  - 3.4.2. Proper activation and deactivation of robots is critical. Robots must only be activated in the arena, testing areas, or with expressed consent of the event and its safety officials.
  - 3.4.3. All robots must be able to be FULLY deactivated, which includes power to drive and weaponry, in under 30 seconds by a manual disconnect.
  - 3.4.4. All robots not in an arena or official testing area must be raised or blocked up in a manner so that their wheels or legs cannot cause movement if the robot were turned on. Runaway bots are VERY dangerous.
  - 3.4.5. Locking devices: Moving weapons that can cause damage or injury must have a clearly visible locking device in place at all times when not in the arena. Locking devices should be painted in neon orange or another high-visibility color. Locking devices must be clearly capable to stopping, arresting or otherwise preventing harmful motion of the weapon.
  - 3.4.6. Weapon locking pins must be in place when weapon power is applied during a robot's power-on procedure. This includes all powered weapons regardless of the power source or weight class.
  - 3.4.7. It is expected that all builders will follow basic safety practices during work on the robot at your pit station. Please be alert and aware of your pit neighbors and people passing by.
  - **3.4.8.** All Competitors **must** wear safety glasses at all times while in the designated pit area.

#### 4. Weight Classes

- **4.1. The weight limit for this event is 2 lb. (~907g).**
  - 4.1.1. Two or more robots may fight together as a “multi-bot team” so long as the combined weight of all member robots does not exceed 2.5lbs (~1134g), and no single robot in the team weighs less than 0.5lbs (~227g). One of the robots must be designated the primary bot. If the primary bot is disabled, the entire multi-bot team is considered defeated. All damage done by any of the robots in the multi-bot team counts for points (see the scoring document for more information).
  - 4.1.2. Non-wheeled robots may qualify for a weight bonus of 25%. if the event supervisor is contacted during registration and the robot is officially determined to be a non-wheeled robot by the judges during safety check. If a member of a multi-bot team qualifies as non-wheeled, the weight bonus is equal to 25% multiplied by the fraction of the multi-bot team qualifying as non-wheeled, and applies to the increased weight limit already associated with multi-bots.
  - 4.1.3. All robots will be weighed during the safety check, after this they may not be modified until after the robot’s first battle, unless such modifications are necessary to comply with competition rules, repair fundamental operations of the robot, or are mandated by a competition supervisor.
  - 4.1.4. In the event that judges suspect a robot may have gained an unfair advantage due to modifications after safety check that increase weight, the robot may be officially reweighed by the judges prior to its next battle.

#### 5. Mobility

- 5.1. All robots must have easily visible and controlled mobility in order to compete. Methods of mobility include but are not limited to:
  - 5.1.1. Rolling - “wheeled” (wheels, tracks, treads or the whole robot)
  - 5.1.2. Non-wheeled: non-wheeled robots may qualify for a weight bonus of 25% if the event supervisor is contacted during registration.
    - 5.1.2.1. Shuffling (rotational cam operated legs)
    - 5.1.2.2. Ground effect air cushions (hovercrafts)
    - 5.1.2.3. Jumping and hopping
    - 5.1.2.4. Flying vehicles are allowed but may be severely limited by the dimensions or the arena. Contact the event supervisor if you intend to utilize a flying robot.
    - 5.1.2.5. Any other mobility method that is determined by event supervisors to not entail continuous rolling motion.

#### 6. Robot Control Requirements:

- 6.1. Tele-operated robots must be radio controlled, or use an approved custom system. Radio controlled robots must use approved ground frequencies contact event supervisors if there is a specific system you intend to use.
- 6.2. Tethered control is available only if the event supervisors are contacted before event. Tethered control is not recommended for this competition. Two robots that use tethered control may not fight each other. Any tether used will be provided by event supervisors.
- 6.3. Pre 1991 non-narrow band radio systems are not allowed.
- **6.4.** Radio systems that stop all motion in the robot (drive and weapons), when the transmitter loses power or signal, are required. This may be inherent in the robots electrical system or be part of programmed fail-safes in the radio. The effectiveness of your fail-safe will be tested during the second part of safety check — test this beforehand!
- 6.5. The transmitter must be capable of being turned off via a switch or button.

## 7. Autonomous/Semi-Autonomous Robots:

- 7.0. Any robot that moves, seeks a target, or activates weapons without human control is considered autonomous. If your robot is autonomous you are required to contact this event before registration.
- 7.1. Autonomous robots must have a clearly visible light for each autonomous subsystem that indicates whether or not it is in autonomous mode, e.g. if your robot has two autonomous weapons it should have two “autonomous mode” lights (this is separate from any power or radio indicator lights used).
- 7.3. The autonomous functionality of a robot must have the capability of being remotely armed and disarmed. (This does not include internal sensors, drive gyros, or closed loop motor controls.)
  - 7.3.1. While disarmed, all autonomous functions must be disabled.
  - 7.3.2. When activated the robot must have no autonomous functions enabled, and all autonomous functions must failsafe to off if there is loss of power or radio signal.
  - 7.3.3. In case of damage to components that remotely disarm the robot, the robot’s autonomous functions are required to automatically disarm within one minute of the match length time after being armed.

## 8. Batteries and Power

- 8.1. The only permitted batteries are ones that cannot spill or spray any of their contents when damaged or inverted. This means that standard automotive and motorcycle wet cell batteries are prohibited. Examples of batteries that are permitted: gel cells, Hawkers, NiCads, NiMh, dry cells, AGM, Li-Ion, LiFe, LiPoly, etc. If your design uses a new type of battery, or one you are not sure, please contact.
- 8.2. All onboard voltages rated above 12 Volts require prior approval at this event. (It is understood that a charged battery's initial voltage state is above their nominal rated value)
  - 8.2.1. Multiple batteries may be added using any combination of series and parallel circuitry as long as the circuit’s voltage remains rated under 12V at all points.
- **8.3.** All electrical power to weapons and drive systems (systems that could cause potential human bodily injury) must have a manual disconnect that can be activated within 15 seconds without endangering the person turning it off. (E.g. No body parts in the way of weapons or pinch points.) Shut down must include a manually operated mechanical method of disconnecting the main battery power, such as a switch or removable link. Relays may be used to control power, but there must also be a mechanical disconnect. Please note that complete shut down time is specified in section 3.4.3.
- 8.4. All efforts must be made to protect battery terminals from a direct short and causing a battery fire. Robots that experience battery fire during combat might not be allowed to continue competing, this is at the discretion of event supervisors and based on the severity of incidents.
- 8.5. All Robots must have a light easily visible from the outside of the robot that shows its main power is activated.

## 9. Pneumatics (Contact during registration if you intend to use Pneumatics)

- 9.1. Pneumatic systems on board the robot must only employ non-flammable, nonreactive gases (CO<sub>2</sub>, Nitrogen and air are most common). It is not permissible to use fiber wound pressure vessels with liquefied gasses like CO<sub>2</sub> due to extreme temperature cycling.
- 9.2. You must have a safe and secure method of refilling your pneumatic system.
- 9.3. Robots may not use pressures exceeding 250psi in any part of the robot, including any onboard storage tank.
- 9.4. All pneumatic systems must have a manual main shut off valve to isolate the rest of the system from the source tank. This valve must be easily accessed for robot de-activation and refilling.

- 9.5. All pneumatic systems must have a manual bleed valve downstream of the main shut off valve to depressurize the system. This bleed valve must be easily accessed for deactivation. This valve must be left OPEN whenever the robot is not in the arena to ensure the system cannot operate accidentally.
  - 9.5.1. It is required to be able to easily bleed all pressure in the robot before exiting the arena. (You may be required to bleed the entire system if it is believed that you have any damaged components.)
- 9.6. Builders are expected to use components appropriate for the pressures that will be present in the robot, judges will inspect the quality of the system prior to approving it for use during the competition.

10. Hydraulics are not permitted at the WyoBots competition.

11. Internal Combustion Engines (ICE) and liquid fuels are not allowed.

12. Rotational weapons or full body spinning robots

- 12.1. Spinning weapons must come to a full stop within 30 seconds of power-down without any other outside intervention.

13. Springs and flywheels

- 13.1. Springs must be safely defused at the end of a battle and cannot store energy while outside the arena and testing areas.
- 13.2. Any flywheel or similar kinetic energy storing device must not be spinning or storing energy in any way unless inside the arena or testing area.
  - 13.2.1. There must be a way of generating and dissipating the energy from the device remotely under the robot's power.
- 13.3. All springs, flywheels, and similar kinetic energy storing devices must fail to a safe position on loss of radio contact or power.

14. Forbidden Weapons and Materials. The following weapons and materials are absolutely forbidden from use:

- 14.1. Weapons designed to cause invisible damage to the other robot. This includes but is not limited to:
  - 14.1.1. Electrical weapons
  - 14.1.2. RF jamming equipment, etc
  - 14.1.3. RF noise generated by an IC engine. (Please use shielding around sparking components)
  - 14.1.4. EMF fields from permanent or electro-magnets that affect another robot's electronics.
  - 14.1.5. Entangling Weapons or defenses: these are weapons or defenses that can reasonably be expected to stop drive train and/or weapon motion by being wrapped around rotating parts. This includes nets, tapes, strings, and other entangling materials or devices.
  - 14.1.6. Weapons or defenses that that can reasonably be expected to stop combat completely of both (or more) robots.
- 14.2. 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:
  - 14.2.1. Liquid weapons. Additionally a bot may not have liquid that can spill out when the robot is superficially damaged.
    - 14.2.1.1. Liquid/fluid tanks should not be present on any robot, and robots should not contain any fluids other than those used to grease motion parts. Section 9 outlines the rules for pneumatic systems.
  - 14.2.2. Foams and liquefied gasses
  - 14.2.3. Powders, sand, ball bearings and other dry chaff weapons

- 14.3. Un-tethered Projectiles (see tethered projectile description in section 15.1)
  - 14.4. Heat and fire are forbidden as weapons. This includes, but is not limited to the following:
    - 14.4.1. Heat or fire weapons of any kind
    - 14.4.2. Flammable liquids or gases (includes use of flammable grease in robot)
    - 14.4.3. Explosives or flammable solids
    - 14.4.4. Deliberate short-circuit or other electrical heating
  - 14.5. Light and smoke based weapons that impair the viewing of robots by an Entrant, Judge, Official or Viewer. (You are allowed to physically engulf your opponent with your robot however.) This includes, but is not limited to the following:
    - 14.5.1. Smoke weapons
    - 14.5.2. Lights such as external lasers above 'class II' and bright strobe lights which may blind the opponent.
  - 14.6. 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. Contact the event supervisors if you have a question.
15. Special weapon descriptions allowed at this event:
- 15.1. Tethered Projectiles are allowed at this event.
    - 15.1.1. Tethered projectiles must have a tether or restraining device that stops the projectile and is no longer than 2 feet. Contact the event supervisors if you plan to use tethered projectiles.

