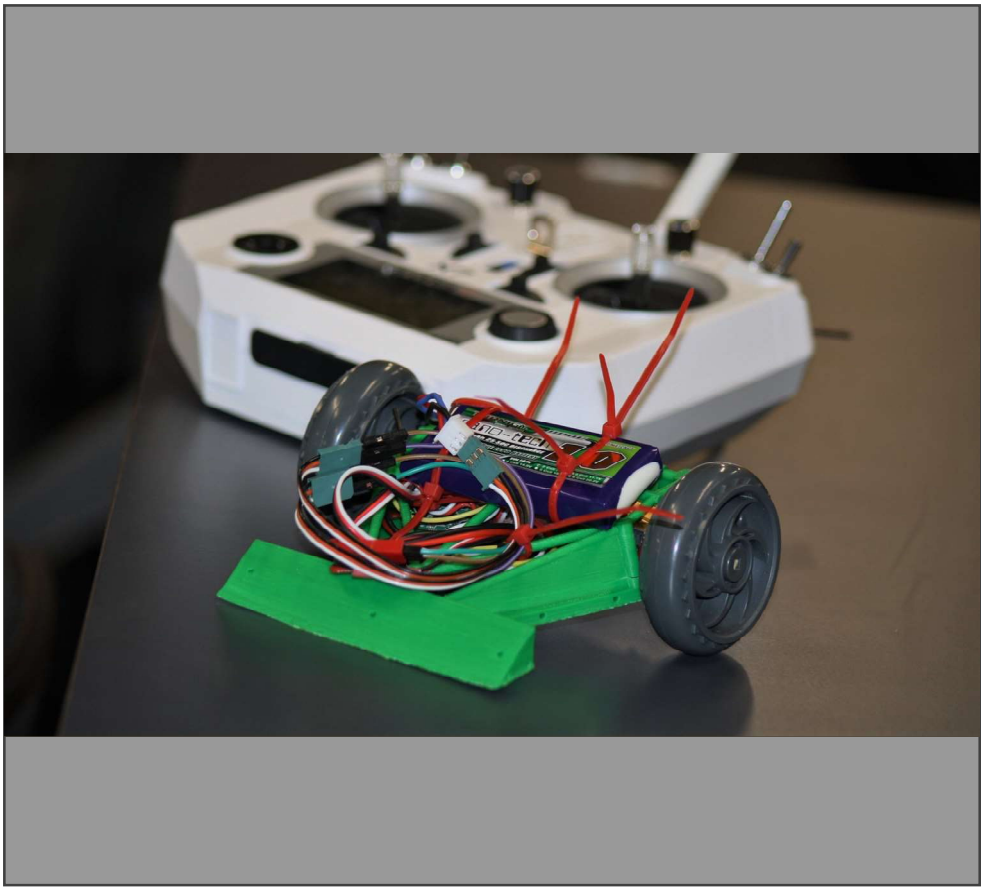
University of Canterbury Fighting Robotics Official Rulebook

Last revised 20/08/2019



Presented by UC Robotics Club

hello@ucrobotics.org.nz
www.facebook.com/UCRoboticsOfficial/
http://ucrobotics.org.nz

Table of Contents

FOREWORD

This project has been a goal of UC Robotics since the club's inception. Thanks to the support of past and current members, alongside an incredible network of secondary school teachers here in Canterbury, we are excited to provide our Combat Robotics framework for Christchurch.

Several aspects have been considered in the delivery of UCFR (University of Canterbury Fighting Robotics). Both safety and availability to all ages were primary concerns, and our arena and parts kits have been built with this in mind.

I would like to give a big thank you to everyone who worked on setting this up, the true heroes of our modest club. To those reading this – I hope our efforts are appreciated, and that everyone has the chance to build some kick-ass robots.

Jake Mayston, UC Robotics President, 20/08/2018

------- --- ------- --- ------- --- -------

Combat Robotics as a sport is fairly new to New Zealand – there has been a substantial revival of the scene overseas, which caught onto Auckland, and now we're bringing it to Christchurch.

Bringing a concept like *combat robotics* into a university environment hasn't been the easiest, but if you are reading this right now then you'll know that it was absolutely worth the effort. I hope this tournament will engage more people into the field of engineering and robotics, no matter what you're studying – for instance I'm in my 4th year of Law/Arts and this rulebook is proof that I happen to be useful to a robotics group.

That aside, I am surely thankful for the opportunity of being involved in this project. I look forward to seeing how it develops in the future.

Gracie Kim, UC Robotics Vice President, 20/08/2018

BUILD AND DESIGN RULES

1. Weight Class Divisions

1.1. The following list comprises of weight classifications with their maximum weight allowances:

1.1.1. Antweight – 150g
1.1.1.1. The maximum size allowance for Antweights are within a 4” cube.
1.1.1.2. In the case of having multiple Botlets, this maximum size allowance applies per Botlet, however the maximum weight is measured collectively.

1.2. Maximum weight includes all electronic components and batteries, but does not include any safety covers and locking mechanisms that are removed when a Robot is activated.

2. Mobility

2.1. The following types of mobility are allowed:

2.1.1. **Rolling** – where parts of the Robot, or the Robot as a whole, moves on a drive output involving rolling mechanisms such as wheels, treads, and tracks.
2.1.2. **Walking** – where the Robot moves on a drive output involving the use of legs or feet on alternating motors to support its weight.
2.1.3. **Shuffling** – where the Robot moves on a drive output involving the use of legs or feet via a rotational cam operation.

2.2. Robots using the following types of mobility are entitled to a weight bonus:

2.2.1. **Walkers** – Additional 100% of the maximum weight allowance of its class.
2.2.2. **Shufflers** – Additional 50% of the maximum weight allowance of its class.

2.3. The following types of mobility are prohibited:

2.3.1. **Flying** – Flying robots are not allowed unless prior approval regarding the use of airspace has been granted by the University of Canterbury Students’ Association (UCSA) and/or the University of Canterbury.
2.3.2. **Jumping** – includes both jumping and hopping mechanisms, for the sole purpose of intentionally propelling the Robot upwards.

2.4. All locomotion must be designed to keep the Robot on the ground at all times.

3. Weapons

3.1. The design must ensure that the Weapon cannot be fired during the activation process.

3.2. The following Weapon types are strictly prohibited:

3.2.1. Explosive-based Weapons
3.2.2. Fire-based Weapons
3.2.3. The use of electrical discharge as a Weapon
3.2.4. Weapons based on pressurized fluids, including gas
3.2.5. Liquids-based Weapons
3.2.6. Projectile-based Weapons, or Weapons that otherwise detach completely from the Robot
3.2.7. Magnetic systems as a Weapon
3.2.8. Entanglement devices

3.3. Weapons that deliberately detach completely from the Robot are strictly prohibited.

4. Robot Control Requirements

4.1. Tele-operated Robots must be radio-controlled. Radio-controlled Robots must use approved ground frequencies, typically 2.4Ghz for New Zealand.

4.2. All Robot radio systems must not cause any interference to any other frequency users.

4.3. All Robot radio systems must have a way to change frequencies or coded channels to prevent radio conflicts. Having at least two (2) frequencies or coded channels available is required.

4.4. All Robots with a radio system must incorporate a **failsafe**, that ceases all operations of a Robot when the radio signal from the transmitter is lost. All failsafes may stop the Robot for only the duration of signal loss, and do not need to permanently remove all power.

4.5. A separate power switch for the radio is not required, but is advised.

4.6. Reserved frequencies or channels for testing and safety purposes will usually not be provided.

4.7. Tether control is not permitted.

5. Power and Batteries

5.1. All Robots must incorporate a visible switch that removes all electrical power to Weapons and drive (or any other systems that could potentially cause injury to the human body), that is accessible without endangerment to any person.

5.2. All Robots must have a clearly visible light from the outside of the Robot that indicates that the main power is activated. While it is not mandatory it is recommended that participants incorporate two (2) redundant lights in case one fails.

5.3. Cable management must be sufficiently and suitably insulated for maximum operational current, also to prevent potential entanglement during a Match.

5.4. All onboard voltages must not exceed 48 volts. However, it is understood that the voltage state of a charged battery is initially higher than their nominal rated value.

5.5. Batteries must be adequately protected and secured within the body of the Robot, to minimize the chance of being punctured or coming loose during a Match.

5.6. Only batteries that cannot spill or spray any of their contents when inverted or damaged are allowed.

5.7. Standard car and motorcycle wet cell batteries are strictly prohibited.

5.8. **Lithium Polymer (LiPo) batteries** have specific limitations and extra precautions which must be followed:

5.8.1. Any Team using LiPo batteries must provide a LiPo sack.
5.8.2. During inspection, all LiPo batteries must be removed from the Robot and placed into a LiPo sack, prior to and during charging.
5.8.3. LiPo batteries must be balance charged to prevent damage occurring to the cells. Chargers without an integrated balancing circuitry are not permitted.
5.8.4. It is not mandatory but is advised that a fuse rated below the maximum burst discharge of the battery be fitted. The maximum burst discharge current is calculated by the C rating by the capacity.
5.8.5. In the interests of health and safety, any charging of Lithium batteries must never be left unattended.
5.8.6. Any damaged or swollen LiPo batteries must immediately be placed into a LiPo sack or a provided sand bucket, and taken outside. Please note that LiPo fires occur rapidly and can therefore be a serious risk to personal injury.

6. Autonomous and Semi-Autonomous Robots

6.1. Any functions of a Robot that is designed to move, seek objectives, and/or activate Weapons without the use of human control is considered autonomous.

6.2. The design must ensure that the Robot's autonomous functions cannot be activated during the activation of the Robot itself.

6.3. Any autonomous functions on a Robot must have the capability to be remotely disarmed. This does *not* include internal sensors, drive gyros, or closed loop motor controls.

6.4. All Robots that have any autonomous system must have a clear and visible light that indicates when the Robot is in its "autonomous mode". It is not mandatory but is advised for participants to incorporate two (2) redundant lights in case one fails.

TOURNAMENT RULES

7. Definitions

Arena – The designated area measuring 1200mm wide and 1800mm long including corner pits, with a polycarbonate cover on top. All Matches take place inside the Arena.

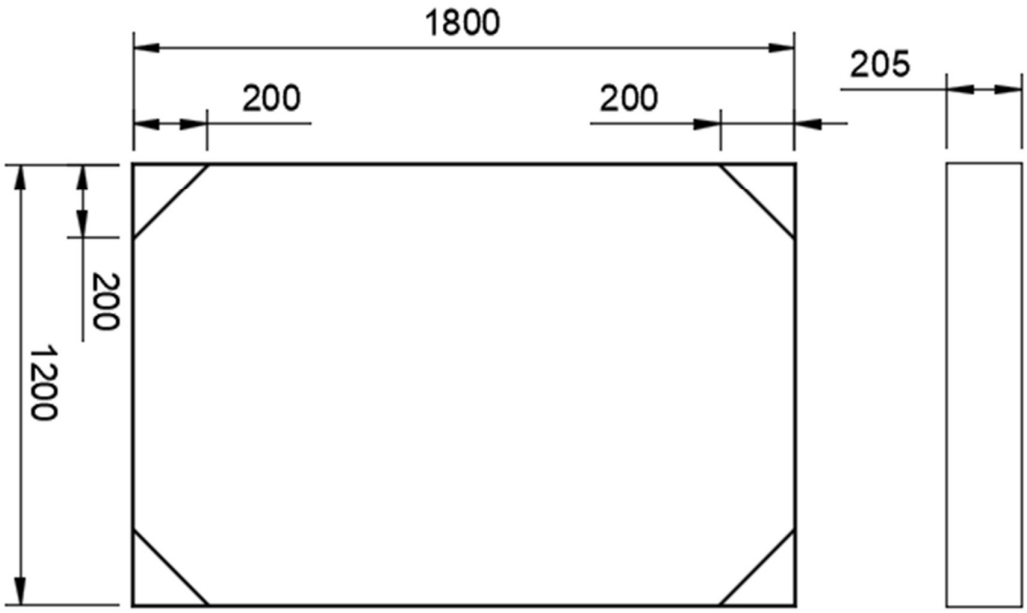


Fig. 1: Layout of the Arena

Disablement – A Robot status, where the Robot has lost controlled translational movement. If the Robot cannot demonstrate any controlled translational movement for ten (10) consecutive seconds, it is considered Disabled.

Disqualification – A type of penalty applied to a Team for a rule violation. A Team that receives a Disqualification will be disallowed to compete in the rest of the tournament, and/or will receive a loss for the Match they violated the rules in.

Drive Team Member – Three (3) members of a Team are allowed in the Drive Team Station during a Match. Only the Drive Team Members are allowed to touch their controls and interact with a Robot at any time during a Match. However, during a Match there can be only one **Driver**. In the case of multiple botlets, there can be only one **Driver** per botlet.

Drive Team Station – The designated region where Drive Team Members must remain during a Match.

Entanglement – A Robot status, where a Robot grabs, hooks, or attaches to an opposing Robot, with the intention that it cannot escape the attachment.

Match – All Matches last three (3:00) minutes, and take place inside the Arena.

Match Affecting – A rule violation status determine by the Referee. A rule violation is Match Affecting if it changes the winning and losing Teams in the Match. Multiple rule violations within a Match can cumulatively become Match Affecting.

Participant – Any student enrolled, or any staff member working, at the University of Canterbury, who is also in a registered Team.

Robot – Any thing that has passed inspection that a Team places on the field prior to the start of a Match.

Team – One or more Participants make up a Team.

Test Box – one of three (3) designated boxes [add measurements here] for Teams to test their Robots in.

8. Match Rules

8.1. The Matches are played in a ladder format, for a 6-Team tournament. Each team will have a 1-on-1 individual round to determine 3 (three) Quarter Finalists, and each Round's loser will be placed into the Redemption Rumble to determine the last Quarter Finalist, which will bring that Robot back into the tournament. This tournament bracket may be modified depending on the event, and the number of Teams registered:

<table>
<tr><td>Team 1</td><td rowspan="2">Round 1</td><td></td><td></td><td></td></tr>
<tr><td>Team 2</td><td rowspan="2">Quarter Finals</td><td></td><td></td></tr>
<tr><td>Team 3</td><td rowspan="2">Round 2</td><td rowspan="4">Semi Finals</td><td></td></tr>
<tr><td>Team 4</td><td></td><td rowspan="2">Final</td></tr>
<tr><td>Team 5</td><td rowspan="2">Round 3</td><td></td></tr>
<tr><td>Team 6</td><td rowspan="2">Quarter Finals</td><td></td></tr>
<tr><td></td><td rowspan="2">Redemption Rumble</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

Fig. 2: Match Schedule

8.2. Before the beginning of the tournament, each and every Robot must be verified by an Inspector. Any Robot that fails an inspection will not be allowed to participate in the tournament.

8.3. All Matches will be adjudicated by a panel of 3 (three) Judges. Match that does not result in a clear victory will be scored and voted by these judges (see section 13).

9. Combat Rules

9.1. A Robot must be placed in the Arena and be prepared for a Match within a maximum of five (5) minutes of being announced by a Volunteer. **Failure to show in adequate time before a Match will occur in a loss for that Team.**

9.2. All Matches will take place inside the Arena.

9.3. All Drive Team Members must stay within the Drive Team Station of their assigned colour at all times during the Match.

9.4. The Match begins on the call of the Referee. Each Match lasts three (3) minutes, beginning from this point of call.

9.5. Robots may hold or pin each other for no longer than twenty (20) consecutive seconds. The Referee will call for disengagement at 15 seconds into any holding or pinning. If the Robots do not disengage, the Match will be restarted.

9.6. Any Entanglement results in an automatic Disqualification to the Team who initiated it.

9.7. The Referee will declare a **Knockout ('KO')** after:

9.7.1. A Robot becomes Disabled (refer to section 3);
9.7.2. A Robot's batteries are visibly displaced;
9.7.3. A Robot has caught on fire; or
9.7.4. A Robot is physically pushed over and into one of the corner ditches.

9.8. A loss of an active Match will occur:

9.8.1. When the Robot is Knocked Out;
9.8.2. When the Robot Entangles another Robot;
9.8.3. According to the Judges' decision.

9.9. At the end of a Match, the Driver is responsible for deactivating any Weapons, as well as otherwise making sure the Robot is in a safe condition before removal from the Arena. Additionally, any locking mechanisms and covers must be fitted back onto the Robot before it can be removed.

9.10. All decisions during a Match are at the sole discretion and judgment of the Referee.

9.11. Any Participant who argues, harasses, verbally abuses, or otherwise acts in a manner that lacks good sportsmanship toward the Referee is entitled to a Disqualification (see 2.2)

10. Judges' Vote

10.1. Where it is required, the Judges must consider **four (4) categories**, as follows:

10.1.1. **Damage (2 points):** Judged by a Robot's use of deliberate action to reduce the functionality, effectiveness, or defensibility of an opponent. Damage is not considered relevant if a Robot inadvertently harms itself. The panel may assign 1 point to each Robot if they believe both Robots performed an equal amount of Damage.

10.1.2. **Aggression (1 point):** Judged by the frequency, severity, boldness, and effectiveness of attacks deliberately initiated by a Robot against its opponent using its powered Weapons. Accidental attacks do not count as Aggression. Consideration is also given if the attacking Robot is risking serious damage on each attack. However, continuous attacks without the use of an active Weapon (eg. ramming, pinning) can reduce a Robot's chance of receiving this point.

10.1.3. **Control (1 point):** Judged by a Robot's ability to attack an opponent at its weakest point, use its Weapons in the most effective way, and minimize the damage caused by the opponent.

10.1.4. **Strategy (1 point):** Judged by the way a Robot may exhibit a combat plan that exploits the Robot's strength against the weaknesses of its opponent. Strategy is also defined as a Robot exhibiting a deliberate defence plan that guards its weaknesses against the strengths of the opponents.

10.2. Each Judge will assign points between the Robots, and the Robot with the higher amount of points will effectively be that Judge's vote. The Robot with the most votes wins the Match.

10.3. In the case of a Match going to a Judges' Decision, the final decision cannot be contested or appealed.

HEALTH AND SAFETY RULES

11. Health and safety procedures

11.1. Each event has safety inspections before the tournament. All teams are obligated to disclose any operating principles and potential hazards at inspection. Your Robot's eligibility to compete will be at the discretion of the Inspector.

11.2. All Robots must have their Weapons secured with a locking mechanism and any sharp or pinching hazards covered when not in the Arena or a Test Box. Locking mechanisms and covers must remain on the Robot during inspection, however they may be removed within the Arena or a Test Box before activation.

11.3. All Robots present at the tournament may strictly only be activated within the Arena before an impending Match or in a Test Box under the supervision of a Test Box Supervisor.

11.4. All Robots not in the Arena or a Test Box must be raised or blocked up in a way that any mobility mechanisms cannot move if the Robot were to be activated. Failure to do so may result in Disqualification – runaway Robots can be **very** dangerous.

11.5. For purposes of preventing any human injury including tripping, all Teams must keep their designated area to a standard of reasonable tidiness. Consideration toward other Teams and Participants is a practice of good sportsmanship and is highly encouraged.

11.6. All Participants build and operate Robots at their own risk. Compliance with all rules is mandatory, however it is expected that Participants stay within the rules and procedures of their own accord and do not require constant supervision.

11.7. If you have a Robot or Weapon design that may be borderline or ambiguous within the rules, please contact the University of Canterbury Robotics for further advice.

11.8. All health and safety procedures are in compliance with the University of Canterbury Students' Association ("UCSA").

12. Disciplinary action

12.1. The Tournament Manager has the right to exercise disciplinary action to any Participant at their discretion, should there be any valid reason that the Participant in concern is acting in an unsatisfactory manner for:

12.1.1. Actions in breach of the rules;
12.1.2. Actions in a manner of bad faith toward staff or other Participants; or
12.1.3. Actions in a manner that put staff or other Participants at a risk of physical safety; and
12.1.4. Just being a dick.

12.2. Where any such disciplinary action is required, the Tournament Manager has the right to order the Participant to leave.

12.3. If at any time the Robot's operation or a Team's behaviour cause any damage to any university property, the Arena or to any other persons, the offending Team may be Disqualified at the discretion of the Tournament Manager.

12.4. University of Canterbury Robotics reserves the right to change any of the rules specified in this book.