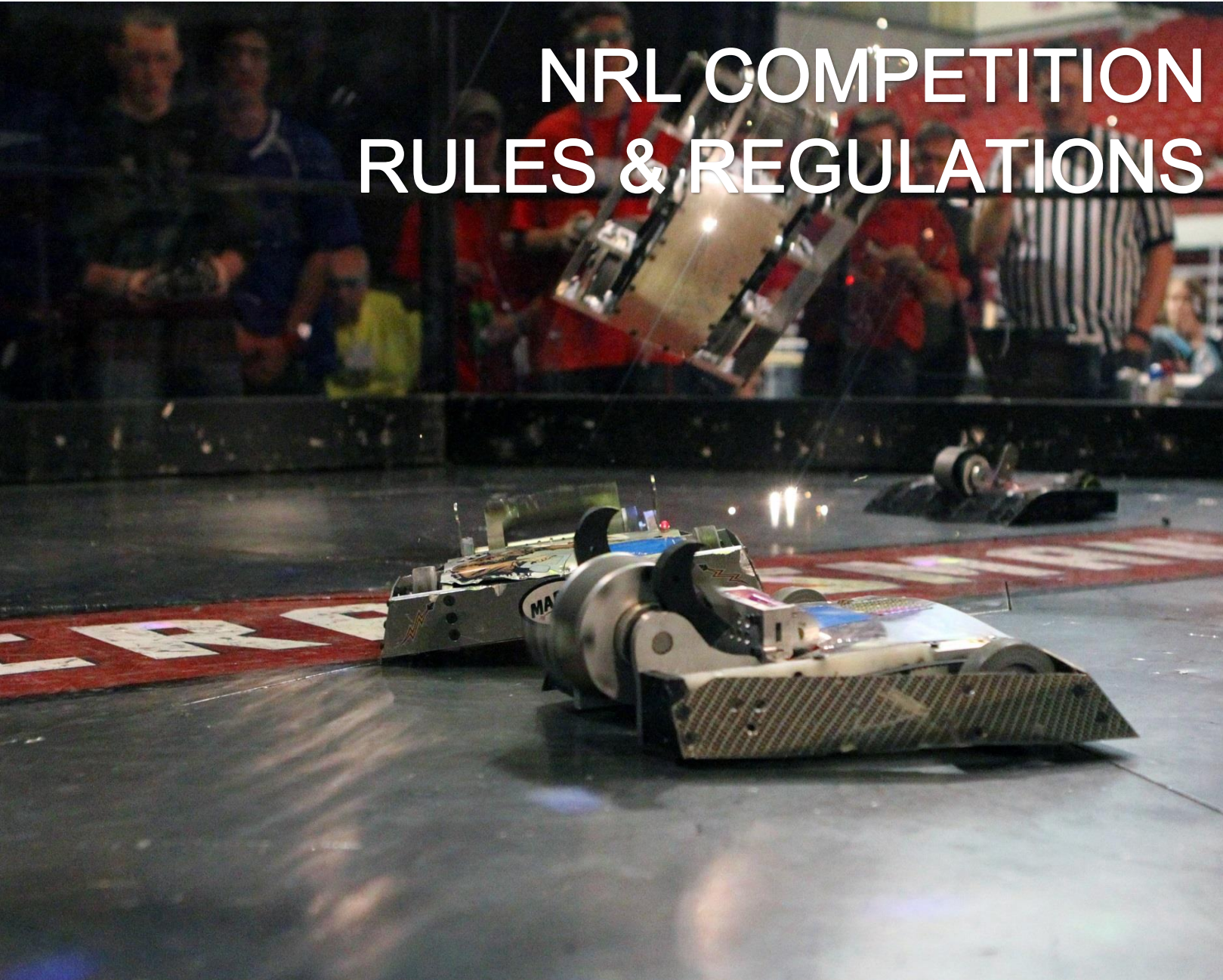




# NRL COMPETITION RULES & REGULATIONS





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## Engaging Manufacturing's Next Generation



### 1.0 INTRODUCTION

#### 1.1 NRL

The National Robotics League (NRL) is a manufacturing workforce development program of the National Tooling & Machining Association (NTMA) and the National Tooling & Machining Foundation (NTMF). The NRL is a job-driven, project-based STEM learning program that energizes students to learn about the manufacturing process and the technical skills needed for the design and fabrication of a 15lb Bot to battle in a gladiator-style competition.

The student teams are encouraged to build partnerships with local manufacturing companies and post-secondary institutions during the Bot building process. This provides the students with direct application of classroom concepts to real world manufacturing situations. The NRL endows students with the 21st century skills needed by industry including project and time management, teamwork, problem solving and critical thinking. As a result of participation in the NRL program and interactions with industry mentors, students discover the excitement and rewards of a career in manufacturing.

#### 1.2 NRL VISION & MISSION

The NRL's vision is for every student in the nation to consider manufacturing as a viable career option. The NRL's mission is to provide an exciting, hands-on experience through business/education partnerships to build the current and future workforce needed by the manufacturing industry.

#### 1.3 YEARLY NRL COMPETITIONS

Regional Competitions are managed by local NTMA chapters and affiliated organizations. The dates, times and locations of the Regional Competitions are decided by the individual local organizing entities and are posted on the NRL website. The National Competition will be held annually during the 3rd weekend of May. The NTMA-WD Board of Directors and NTMA Staff will determine competition dates and location.

#### 1.4 CONTACTING NRL

For questions, comments, requests, and clarifications regarding the competition rules, technical regulations, and procedures in any NRL document, contact the NTMA Staff.

Bill Padnos

Director of Youth Engagement | National Tooling and Machining Association

1357 Rockside Road, Cleveland, OH 44134

Direct Tel: 216/264-2828 | Email: [bpadnos@ntma.org](mailto:bpadnos@ntma.org) | Website: [www.goNRL.org](http://www.goNRL.org)

For questions, comments, requests, and clarification regarding a specific regional competition, contact your Regional Event Organizer.

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## 2.0 GENERAL INFORMATION

### 2.1 COMPETITION

- 15 lb. Bots compete against each other in a head-to-head match.
- The match will last 3 minutes or until one Bot is knocked out or taps out.
- The National Competition will be a double elimination tournament.
- Regional Competitions may be formatted as double elimination or Round-Robin depending on the number of Bots competing.

### 2.2 CLASSES

NRL's goal is to have separate classes for middle school, high school, and postsecondary. We will be combining all three classes for competitions until there are a sufficient number of Bots in each class to separate the classes.

### 2.3 TEAMS

A team is defined by its name and its affiliated school or youth organization. A team includes at least three students and at least one adult Coach and an Industry Advisor. There is no limit to the number of students allowed on a team. If the number exceeds 10, please contact the Event Organizer prior to the Competition to ensure adequate space in the pit area. Definitions and responsibilities are as follows:

The Coach or Teacher is responsible for the students and must be at least 21 years old and affiliated with the school or organization.

An Industry Advisor is a professional that assists the team and offers them advice. They may be from a local company, post-secondary institution or parent. There is no limit to the number of teams an Industry Advisor helps or how many Industry Advisors a team has.

Students on the team must be currently enrolled at a middle school, high school, or a post-secondary educational institution. Each Student must have contributed to the design and construction of the Bot, and may be asked questions about the Bot by an NRL representative during a competition. A Student may only be a member of one team. To form a team based in a qualified youth organization, contact the NRL for eligibility requirements. Note: the NRL reserves the right to request verification of current student enrollment.

It is assumed that the students do the majority of the work on the Bot with adult supervision when necessary. Non-students, including advisors, coaches, and parents, may not work on the Bot unless they get approval from the Event Organizer, or if intervening to prevent an imminent safety violation. Inadvertently touching the Bot while giving instruction, or holding the Bot while a student works does not count as working on the Bot. All teams are expected to be responsible, safe, follow NRL rules, and be respectful. Fighting, unruly behavior, and disrespectful behaviors will result in immediate expulsion from the competition.

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### 2.4 BOT ELIGIBILITY

The NRL highly encourages teams to design and build new Bots for each competition season. Any team wishing to re-enter a past Bot will be required to submit a description of design improvements or changes that have made other the previous year in order to be eligible to compete. A Bot that wins the First Place Award twice is automatically retired.

Changes should include making new components of some nature for the Bot. Scope of changes required for re-entry of an existing Bot include the redesign and fabrication of at least one (Drive train components, Chassis design, Weapon design or Weapon drive system).

### 2.5 RESOLVING PROBLEMS

If there are any issues that need to be resolved, they should be brought to the attention of the NRL Program Manager at the National Competition, or to the Event Organizer at the Regional Competition. If the issue is a Protest, the rules set forth in Section 9.0 of this document will be followed. For all other issues, the Program Manager will bring the issue(s) to the NRL Advisory Board members to discuss a resolution. This will be completed as soon as possible. In the event that there are not any other NRL Board members available, the Program Manager will decide the outcome. The decision will be final.

### 2.6 INSURANCE

All events will have basic accident insurance coverage. Teams are advised to have their own coverage when not at an event.

### 2.7 PHOTOGRAPHS AND VIDEOTAPING

NRL allows individuals to photograph and videotape the competitions. Individuals are encouraged to display the NRL logo in said photos and videos. Teams will sign a waiver stating their consent to videotaping and photography while at the competition.

### 2.8 NATIONAL COMPETITION AWARDS

The following winners will be recognized at the National Competition: Grand Champion, First Place, Second Place, Third Place, Best Documentation, Best Engineered, Most Innovative Design (optional), and Coolest Bot (voted on by students). The Regional Programs may use this award structure or establish their own.



### 3.0 REGISTRATION REQUIREMENTS

#### 3.1 REGISTRATION AGREEMENT

The NRL Registration Agreement is used to document the organization, team name, Bot name, and the names of the participants. This document and the registration fee must be turned into the NRL before competing.

#### 3.2 REGISTRATION FEE

The official registration fee for the NRL National Competition is \$100 per Bot. There is a \$50 per Bot discount available to every team that registers at least one volunteer for at least 4 hours during the NRL National Competition.

#### 3.3 BOT TRANSPORT

Once a team has checked in, and their Bot has passed safety inspection, the Bot must remain in the competition/pit area until they have checked out at the end of the competition. The competition area will be secured overnight.

#### 3.4 DOCUMENTATION

Engineering Documentation is used to explain the process that a team has used to build their Bot, this documentation process also serves as a learning exercise. The documentation includes: schematics, drawings, photos, timelines, journals, etc. that show the process of building your Bot. Documentation must be submitted by the deadline set in the registration packet, and will be returned to you prior to the end of the competition. A team that fails to provide engineering documentation for its Bot is not eligible to compete.

#### 3.5 TEAM INTERVIEWS

As part of the documentation review process, documentation judges will interview team members. Every team member should be prepared to discuss the entire Bot build process including planning, design, construction, and strategy.



### 4.0 SAFETY RULES

#### 4.1 SAFETY GLASSES

Safety glasses must be worn at all times when in the pit area as well as in the arena area when your bot is competing. Standard prescription glasses do not count as safety glasses. Prescription safety glasses or safety glasses designed to fit over prescription lenses are acceptable. Standard safety glasses should not be worn over prescription lenses. This rule also applies to coaches and technical advisors. Safety is the responsibility of everyone. Non-compliance will result in a match penalty. See Technical Regulations section 1.5 for details.

#### 4.2 BOTS ON BLOCKS

Bots must always be on an approved block platform, so that the wheels cannot touch the ground/table when they are in the pit area.

#### 4.3 SMOKING PROHIBITED

Smoking is prohibited in the workstation pits, welding, and competition areas.

#### 4.4 ALCOHOL AND DRUGS

The use of alcohol or illegal drugs is prohibited anywhere at an NRL Competition.

#### 4.5 PIT AREA RESTRICTIONS

Only team members are allowed in the pit area. Team members will be required to wear the ID that the event provides. This could simply be a wristband or a name badge. Guests may be allowed in the pit area, but only if granted permission by an NRL official. There may be restrictions on the number of people allowed in the pit area, depending on the venue. Teams with over 10 students should check with the Event Organizer before a competition to find out the pit restrictions. Aisles must be kept clear of stationary objects. If needed, teams may use the area under the table for storage.

#### 4.6 CLOTHING

Everyone in the pit area is required to wear appropriate clothing and this includes closed-toed shoes and long pants. Students, teachers or advisors without appropriate clothing will be escorted from the pit area.

#### 4.7 ADULT SUPERVISION

When any team member is working on a Bot, a supervising adult needs to be present. An adult can supervise no more than 2 teams at a time. If every team member is over 18, additional adult supervision is not required. High School students, even those over 18 years of age, are not eligible to provide adult supervision. The coach is responsible for their team members at all times.

#### 4.8 BOT TESTING

All Bot drive and weapon tests need to be performed in a test box, or arena, and NOT the pit area. Bots and controllers must not be turned on in the pit area.



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### 4.9 BOT TRANSPORTATION TO THE ARENA

Any Bot being transported outside the pit area must have safety covers and restraints in place, and they must be completely deactivated until the Bot is placed into the arena.

### 4.10 WEAPONS

Under no circumstance may any body part be placed in the path of a weapon or other moveable Bot part, including during installation, activation or deactivation, or removal of any safety device. A Bot may never be picked up or carried by its weapon.

### 4.11 WEAPON RESTRAINTS

Weapons must be restrained at all times, unless the Bot is in the test box or in the arena. The restraints will only be removed once the Bot has powered on successfully. Weapon restraints must be able to prevent the motion of the weapon.

### 4.12 WELDING/GRINDING

Welding and grinding are not allowed in the pit area. They will be allowed in a designated area. The professional welder provided by the Event Organizer is the only person allowed to weld at the competition. Grinding may be performed in the welding area, and must be supervised by a coach or other supervising adult. Note: not every competition will provide a welder; contact your event organizer to determine if a welder will be available.



## 5.0 MATCHES

### 5.1 MATCH LENGTH

Each match will be three minutes long, unless a Bot is knocked out or taps out before time expires. In the case of Multi-Bot, this is true only when it is the "primary" Bot that is knocked out or taps out.

### 5.2 TOURNAMENT PLACEMENT

The placement of your Bot in the tournament brackets will be random. Minor adjustments may be made to ensure teams from the same school do not compete against each other in the first round.

### 5.3 JUDGING

Matches are judged on three criteria: aggression, control and damage. If the match lasts for the entire three minutes, the judges will decide the winner. The winner will be the Bot or Multi-Bots with the judges' majority votes. There are three judges, each judge entitled to one vote. Judges will be using a scoring card to track the match. All judges must attend training before participating at a competition.

### 5.4 BOT UNSTUCK RULE

Each Bot is allowed one release during the match; this means if your Bot is stuck on the floor or under an arena rail, the referee will stop the match, release the Bot without changing its position, and then restart the match. Being tossed out of the arena (i.e., over the rail, up on the rail or wall, between the rail and wall) or knocked upside down does not constitute being stuck. Multi-Bots are allowed one release total, not one release for each bot.

If both competing teams' Bots are stuck on each other, they will be released as often as needed without changing the Bot's position.

### 5.5 BOT PINNING

If a Bot pins or traps the other Bot, they must release it after the referee counts 10 seconds.

### 5.6 BOT UNABLE TO MOVE

If a Bot is unable to move during the match, the referee will start a 10 second countdown. If that Bot cannot move by the end of the countdown, it will be considered a loss, and the other Bot will be the winner of the match. The referee will decide whether the Bot shows sufficient movement. In the case of Multi-Bots, this is true if it is the "primary" Bot. If it is not the "primary" Bot, the match continues, and there is not a countdown. If both Bots are unable to move after the 10 second countdown, the judges will determine the winner of the match.

### 5.7 TAP OUT

If a team wishes to stop the match at any time, they may loudly declare "Tap Out." This will be an automatic loss for that team. The other team will not be allowed to attack them after they have declared a "Tap Out."



### 5.8 POSTPONEMENTS

Postponements will not be allowed at the National Competition. At the referee's discretion, some leeway will be given at the beginning of the match to troubleshoot transmitter/receiver linking issues. Postponements may be allowed at regional competitions.

There is not an established set time between matches; however, each team will be allowed at least 20 minutes between matches if needed. An NRL official will inform someone in your pit area about your scheduled matches. Please have someone present in your pit area to be notified. Failure to be available could cause your team to forfeit.

### 5.10 DOUBLE ELIMINATION

The National Competition will be a double elimination tournament. Each team is guaranteed two matches.

### 5.11 ROUND ROBIN

Regional Competitions may use the "Round Robin" style tournament. In a Round Robin Tournament, each Bot fights all of their opponents. The winner is decided by the total number of matches won. In the case of a tie, the two Bots that are tied will have a final match to determine the winner.

### 5.12 GRUDGE MATCH

If the Event Organizer feels there is time, they may announce the opportunity for a "Grudge Match." Teams will have the opportunity to sign up to fight a specific opponent. Both teams are required to agree to the match, and both Bots will be required to have been eliminated from the competition to be eligible. They will have a regular three minute match, and the audience will decide the winner. This is purely for fun, and it will not affect any tournament results.

### 5.13 RUMBLE

If the Event Organizer feels there is time, they may announce the opportunity for a "Rumble." Teams will then be offered the opportunity to sign up and fight against an unspecified amount of opponents. All the teams entering their Bots must have already been eliminated from the competition. The "Rumble" will last for three minutes, and the Bot with the most functionality at the end of the "Rumble" event will be declared the winner. Tap-outs will not be permitted. This is purely for fun, and this event will not affect any tournament results.



## 6.0 RADIO CONTROL

### 6.1 RADIO CONTROLLERS

The NRL recommends using the Spektrum Transmitter DX6, due to the corresponding receivers having SmartFail Technology. If a team is utilizing a different transmitter system for the competition, the system must meet the fail-safe protection requirements.

### 6.2 BLUETOOTH CONTROLLERS

Bluetooth systems must be approved by the NRL safety committee prior to the competition. Operating plans, schematics and a clear explanation of the controls must be presented for review.

NRL should receive this information at least one week before the competition so that we can verify it at the start of competition. The Bot must comply with all other regulations, meaning the Bot should be in zero energy state when not in the test box or arena. All power must be off and dissipated. The student should not need to handle the Bot in order to bring the Bot to a zero energy state. The battery must be disengaged by the master switch and any energy storing devices must be automatically drain when the master switch is shut off. The energy storing should only take place when the Bot is on.

Any capacitors or electrical storage devices used in the system must be capable of being safely discharged without putting the students at risk.



## 7.0 INSPECTION PROCEDURE

### 7.1 SAFETY INSPECTOR

Each Competition will have a Lead Safety Inspector. This person will be responsible for the scheduling of the inspections and keeping the inspection sheets for each Bot. This person will be the main contact for any Safety Inspection related questions or comments.

### 7.2 INTERNAL/FUNCTIONAL INSPECTION

Each Bot must pass both an "Internal and Functional Inspection" before competing. An "Internal Inspection" involves inspection of all of the components in a Bot. A "Functional Inspection" involves a demonstration that the Bot can safely be controlled and meets the fail-safe requirement listed in the Technical Regulations. A copy of the inspection form will be provided to each team at registration to use as a checklist.

### 7.3 OFFICIAL SCALE

The NRL will have a specific scale designated as the official scale for that event. Your Bot must make weight using that scale.

### 7.4 INSPECTION TIME SCHEDULE

Safety Inspection will take place during a specified time period prior to the start of the competition. This will be posted prior to the event.

### 7.5 NRL RIGHT TO INSPECT/DISQUALIFY

The NRL reserves the right to inspect or re-inspect your Bot at any time during the competition. Any additions or changes to the Bot must be re-inspected before competing, as well as after any significant damage during a match. If an NRL official feels a Bot is unsafe for any reason and it cannot be made safe, it will be disqualified and not allowed to compete.

### 7.6 MATCH WEIGH-IN

All Bots will be reweighed before each match.

### 7.7 NON-COMPLIANT

If, as the result of re-inspection, a Bot does not comply with the Rules and Regulations, NRL officials will determine the outcome as follows:

- If the non-compliance was not intentional, and would not have affected the outcome of a previous match in which it fought, the previous match results will stand; however, the Bot will need to be modified to make it compliant for future matches.
- If the non-compliance was not intentional, but could have affected the outcome of a previous match in which it fought, the NRL officials can disqualify that Bot and reverse the decision of the previous match if necessary.
- The Bot will then need to be modified to make it compliant for future matches, if that loss did not eliminate them from the competition.



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- If the non-compliance was intentional, the Bot will be disqualified, and any previous wins will be reversed. The non-compliant Bot will not be allowed to compete in any NRL competition for the entire year.
- If the non-compliance was intentional and endangered any person(s) at the competition, the entire team will be asked to leave the competition. That team will not be allowed to compete in any NRL competition for the entire year.

### 7.8 BUILDING CAUTIONS

Combat Bot systems can be dangerous if not designed, constructed, and tested properly. Damage during matches can render the Bot unsafe. It is ultimately the responsibility of Bot teams to ensure the safety of their system design.



## 8.0 RULES ENFORCEMENT

### 8.1 RULES COMPLIANCE

In all matters of compliance with the Rules, and any applicable civil or criminal laws, the NRL and its officials reserve the right to penalize, or disqualify a Bot, or to warn or, expel any team or individual from the competition.

### 8.2 EXPELLED INDIVIDUAL

If an individual is expelled, they must leave the premise and return any and all IDs, pit passes, etc. This individual will not be permitted to compete in any future NRL event for the remainder of the year. If the individual expelled is the adult supervisor, the entire team must also leave the premise.

### 8.3 EXPELLED TEAM

If an entire team is expelled, they will be asked to leave the premise and return any and all IDs, pit passes, etc. They will also need to clear their pit table. They will not be allowed to compete in any NRL event for the remainder of the year.

### 8.4 CRIMINAL OFFENSES

If any person is in apparent violation of any Federal, State, or Local laws, that person will be turned over to the local authorities.



## 9.0 RULES ENFORCEMENT

### 9.1 ALLOWABLE PROTESTS

The following items may be protested:

- The Safety Inspector's decision to fail a Bot during inspection
- A match forfeit due to non-availability
- Disqualification due to an inadvertent rules violation

### 9.2 UNALLOWABLE PROTESTS

The following items may not be protested:

- The Judge's decision on a match
- Disqualification due to an intentional safety violation
- Disqualification due to failure to obey an NRL official's instruction

### 9.3 PROTEST PROCEDURE

The procedure for protesting is as follows:

- The protest must be lodged within 15 minutes of the time the event occurred.
- The protest should be brought to the Program Manager or the Event Organizer.
- All parties involved will be given a maximum of 5 minutes to present their side of the case.
- After all parties have presented their side of the case, the Program Manager or the Event Organizer will make the final decision within one hour after the presentations.
- The decision made by the Program Manager or the Event Organizer will be final.



### GLOSSARY OF TERMS

**Aggression** – The frequency, severity, boldness, and effectiveness of attacks deliberately initiated by one Bot against an opponent. If a Bot appears to have accidentally contacted an opponent, that act will not be considered aggression.

**Arena** – The enclosed area in which the Bots fight.

**Bye** – A Bot does not have to compete in a round and is automatically advanced to the next round. Byes occur in an Elimination Tournament, when it is not possible to schedule a competitor in the current round.

**Competition** – This is the overall process of using a group of matches to identify the winner of the tournament.

**Control** – The ability of the Bot to move in a specific and deliberate manner. Control means a Bot is able to attack an opponent at its weakest point, use its weapons in the most effective way, and avoid being struck by the opponent or its weapons.

**Damage** – Reduce the functionality, effectiveness, or defensibility of an opponent through deliberate action. Damage is not considered relevant if a Bot inadvertently harms itself. Also, if a Bot fragment strikes the opposing Bot, it will not be considered “deliberate.”

**Disqualification** – A Bot that is no longer permitted to compete in the tournament.

**Eliminations** – The standard tournament format composed of successive “Rounds of Competition.” The league format is Double Elimination through the final round.

**Event Organizer** – The main contact person for a particular competition.

**Forfeit** – A Bot loses a match because it was not ready to compete at the scheduled time.

**Grudge Match** – A one-on-one, non-competition match between Bots in the arena. This is reserved for two Bots that have each had two losses. It will follow the standard three-minute match rules. Grudge Matches will be allowed when and if there is time.

**Incapacitated** – A Bot is not responsive. The Referee is the final authority on this call.

**Judging** – Matches are judged on three criteria: aggression, control and damage. If a match goes the full three minutes, the judges will decide the winner. The winner will be the Bot with the most judges’ votes. There are three judges and each has one vote. Judges will be using a scoring card to track the match. All judges must attend training before participating at a competition.

**Knock-Out** – Occurs when the attack or deliberate actions of one Bot cause the opponent to become incapacitated.

**Match** – Any competition between Bots in the arena. This includes the standard three minute match, a Grudge Match, and a Rumble.

**Multi-bot** – Two or more Bots that together meet the weight requirements. They compete as a team against their opponent. One of the bots must be designated as the “primary” bot. This bot must be functional for a match to continue.

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**Pinning** – A Bot pins or traps the other Bot.

**Pit Crew** – The students, coaches, and advisors allowed in the pit area.

**Postponement** – Occurs when a specific match is delayed from the originally scheduled time due to a request by one of the teams. A 20 minute time period will be given for a postponement. A Bot may only use one postponement per event if allowed.

**Round Robin** – A tournament style that allows each Bot to fight all of its opponents once. The winner is decided by the total number of wins.

**Rounds** – One set of matches where all remaining competitors are paired off and compete (or receive Byes) in order to advance in the eliminations.

**Rumble** – Any competition between multiple Bots in the arena. This is reserved for multiple Bots that have all had two losses. It will follow different rules. There are NO Tap Outs, NO unstuck opportunities, and the match is 3 minutes long. There is also no judging. The winner is determined as the Bot that has the most functionality remaining. Rumbles will be allowed when there is time in between the regular competition.

**Scoring** – Three criteria are used to determine the winner of a match that completes the 3 minute time limit (aggression, control, & damage). Judges will be using a scoring card to track the match.

**Spread Spectrum** –We strongly recommend using the Spektrum DX6 or DX7 controller with the BR6000 receiver. Newer receivers with a built-in failsafe are also allowed.

**Tap Out** – Occurs in a match when a driver of a Bot decides that they no longer want to continue the match and concede the win to the opponent. At the time of the tap out, all contact must stop.