



National Robotics League Colorado

A S.T.E.M. PROGRAM

WELCOME TEAMS!

NRL Colorado is a job-driven, project-based STEM learning experience that was created by the manufacturing industry to solve its biggest issue – **recruiting a future workforce**.

NRL Colorado builds on success of robotics programs in our community and makes a direct tie to careers for the next generation — careers in manufacturing.

Why Is It Important?

- There is a **skills and interest gap** in manufacturing.
- **2.4 million manufacturing positions may go unfilled by 2028** (according to a Deloitte Study).
- 90% of parents recognize that a strong manufacturing base is critical to the US economy, but only **30% of parents would support their child's pursuit of a career in manufacturing**.
- **NRL Colorado attracts smart, capable students** who love to build things and solve problems.
- **Potential careers** students can have: buyer, manager, CAD/CAM designer, CNC operator/machinist, welder, assembler, driver, quality control and more!

Benefits of Competing

The benefits of competing are the same as any extra-curricular or in-school activity: social development, improving self-esteem, helping bolster a college application, giving kids a sense of belonging, etc.

But, the NRL Colorado program does even more: it **inspires young people to pursue manufacturing and STEM related careers and helps them gain the technical and critical thinking skills needed for these careers**.

Program Overview

NRL Colorado is a manufacturing workforce development program of the Rocky Mountain National Tooling & Machining Association (RMTMA) to help machine shops fill their workforce pipeline by partnering with local schools.

Students design and build 15-lb remote controlled robots to face-off in a gladiator-style competition.

Through the manufacturing process of bot building, students' imaginations are captured as they design, build and compete with their own robotic creations. Students gain practical knowledge of Science, Technology, Engineering, and Math (STEM) - all essential skills for manufacturing.

By formalizing ties between schools and industry advisors, students gain a better understanding and become enthusiastic about the career possibilities in manufacturing.

The NRL Colorado program helps students realize they can have a high-paying future in manufacturing.

TEACHER'S ROLE



The success of the NRL depends on willing Teachers and Industry Advisors/Mentors from local manufacturing companies. **Only with your help are participating schools able to expose students to years of expertise and a real-world manufacturing environment.**

If you decide to participate, you will:

- Have students complete a survey about manufacturing.
- Plan at least one visit to a partnered machine shop.
- Complete the Safety Inspection Sheet at least one week prior to the Competition and get Industry Advisor's sign-off.
- Meet with a local industry advisor.

What to expect from your local industry advisor:

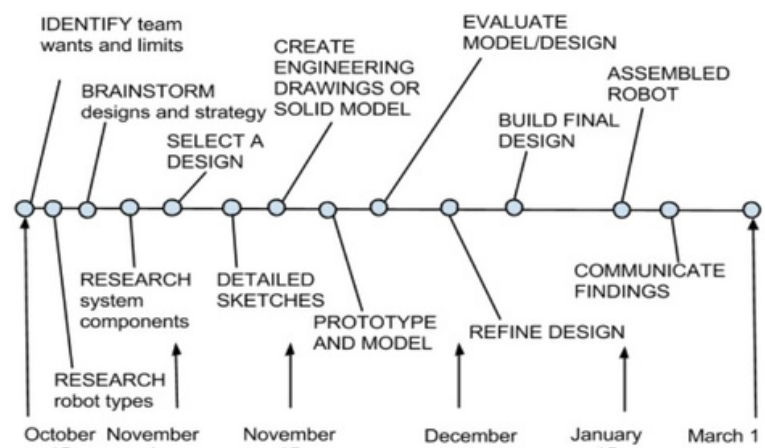
- Assist the team with the design and planning (1-2x; 2 hours min.)
- **Assist in the process of building the 'bot**; this could include machining parts, welding, etc., and/or training the students to accomplish these tasks; it can also include introducing the students to other manufacturing companies and/or vendors, or incorporating students onto the production floor.
- **Explain the importance of documentation** in the manufacturing process; provide real-life examples so the students can understand why it's a critical component of the project.
- **Take the students on a tour of their facility** and create opportunities for them to interact with employees to learn about the benefits of working in manufacturing.
- Provide the team with **access to raw materials**, if possible.
- **Review the team's binder and 'signoff' prior to the Competition** (30-minute review, one week before competition).
- Attend the competition on April 15, 2023.

Timeline

There is flexibility in the timeline; however as a golden rule, the outcome of this program is a reflection of what you put into it.

This is a great opportunity to help students gain the technical and critical thinking skills needed for manufacturing and other STEM-related careers.

Here is a timeline you can use as a guide throughout this project.



RESOURCES FOR TEACHERS & TEAMS



Your Number 1 Resource is your Industry Advisor.

By working with our Industry Advisor, the excitement of competition is just the beginning; they'll help turn the students into passionate and skilled future job candidates in the manufacturing industry.

Team Resource Guide (click [here](#) to access guide)

- Preface
- Warning . . . Read Before Proceeding on the Path to Succeeding
- The NRL Project Timeline
- The Engineering Design Process
- Systems
- Glossary
- Resources
- Technical Regulations

Technical Regulations (click [here](#) to access guide)

- General
- Weight Classes & Size
- Mobility
- Robot Control Requirements
- Autonomous/Semi-Autonomous Robots
- Batteries and Power
- Pneumatics
- Hydraulics
- Internal Combustion Engines (ICE) and Liquid Fuels
- Rotational Weapons or Full Body Spinning Robots
- Springs & Flywheels
- Forbidden Weapons and Materials
- Special Weapon Descriptions Allowed

Safety Inspection Checklist (click [here](#) to access guide)

This checklist must be completed and signed by both teacher and Industry Advisor 1 week prior to Competition. Please present the signed form at the Competition.

Team Binder Documentation & Outline (click [here](#) to access guide)

- Design Motivational/Strategy
- Team Procedures
- Design Process
- Grading Matrix

Rules & Regulations - Complete Guide (click [here](#) to access guide)

This is the complete Rules & Regulations of the NRL. It is good to have a complete understanding of all aspects of the NRL Competition, including safety, judging, and rules enforcement.

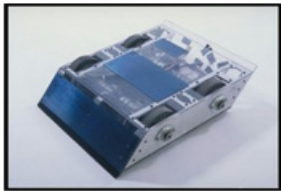
- Introduction
- General Information
- Registration Requirements
- Safety Rules
- Matches
- Radio Control
- Inspection Procedure
- Rules Enforcement
- Protests
- Glossary of Terms for NRL

ROBOT TYPES



Descriptions and more information on each robot type are located in the [Team Resource Guide](#), starting on page 7.

Wedge



Spinner/ Salad bowl



Rammer



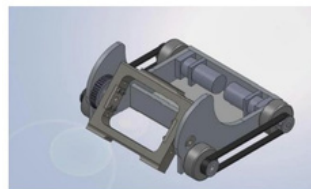
Horizontal-blade



Flipper/ Launcher



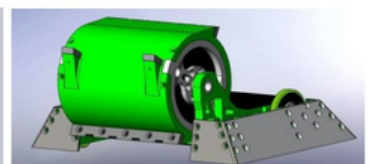
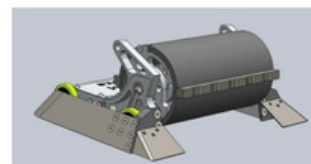
Eggbeater



Hammer/ Thwackbot



Drum



ROBOT TYPES & BASIC LIST OF PARTS



Multi-bot

Multi-bots are somewhat self explanatory, where two or more robots fight as a team against an opponent. The catch with using multi-bots is that the combined weight of the robots must be less than the weight limit of the competition (15 lbs)

Crusher/Shear



Sawblade



Walker



The Basic Parts List of a Robot

Note: Robot body parts have been omitted from the list. Only the basic mechanical and electrical components have been included due to the significant variation in body designs and robot styles. more information on each robot type are located in the Team Resource Guide, starting on page 11

Robot type: 2 wheeled wedge

| Part Name | Notes/description |
|-----------------------------|---|
| Drive motor 1 | Left side, 700 series motor, 5mm shaft, brushless |
| Drive motor 2 | Right side, 700 series motor, 5mm shaft, brushless |
| Planetary gearbox 1 | 16:1, compatible with motors, with 1/2" dia. x 1-1/2" hexagonal shaft |
| Planetary gearbox 2 | 16:1, compatible with motors, with 1/2" dia. x 1-1/2" hexagonal shaft |
| Switch | Screw actuated, 40A+ |
| Battery | NRL approved battery, 12V + NiMH |
| Indicator light (LED) | Power identification light |
| Transmitter | compatible transmitter with receiver (the RC controller, usually a spektrum DX6i) |
| Receiver | 4 channel minimum, with Fail safe capability |
| Wheel 1 | 3-1/2" Dia. with 1/2" hex hub |
| Wheel 2 | 3-1/2" Dia. with 1/2" hex hub |
| Electronic Speed Controller | Scorpion XXL dual motor ESC with BEC |
| (32) #10-32 screws | All screws 1" length |
| 13" 14 AWG red wire | copper noodle wire |
| 16" 14 AWG black wire | copper noodle wire |
| 9 sets of wire connectors | 9 male and 9 female connectors |
| 1, 8" RC wire | to power LED from receiver |