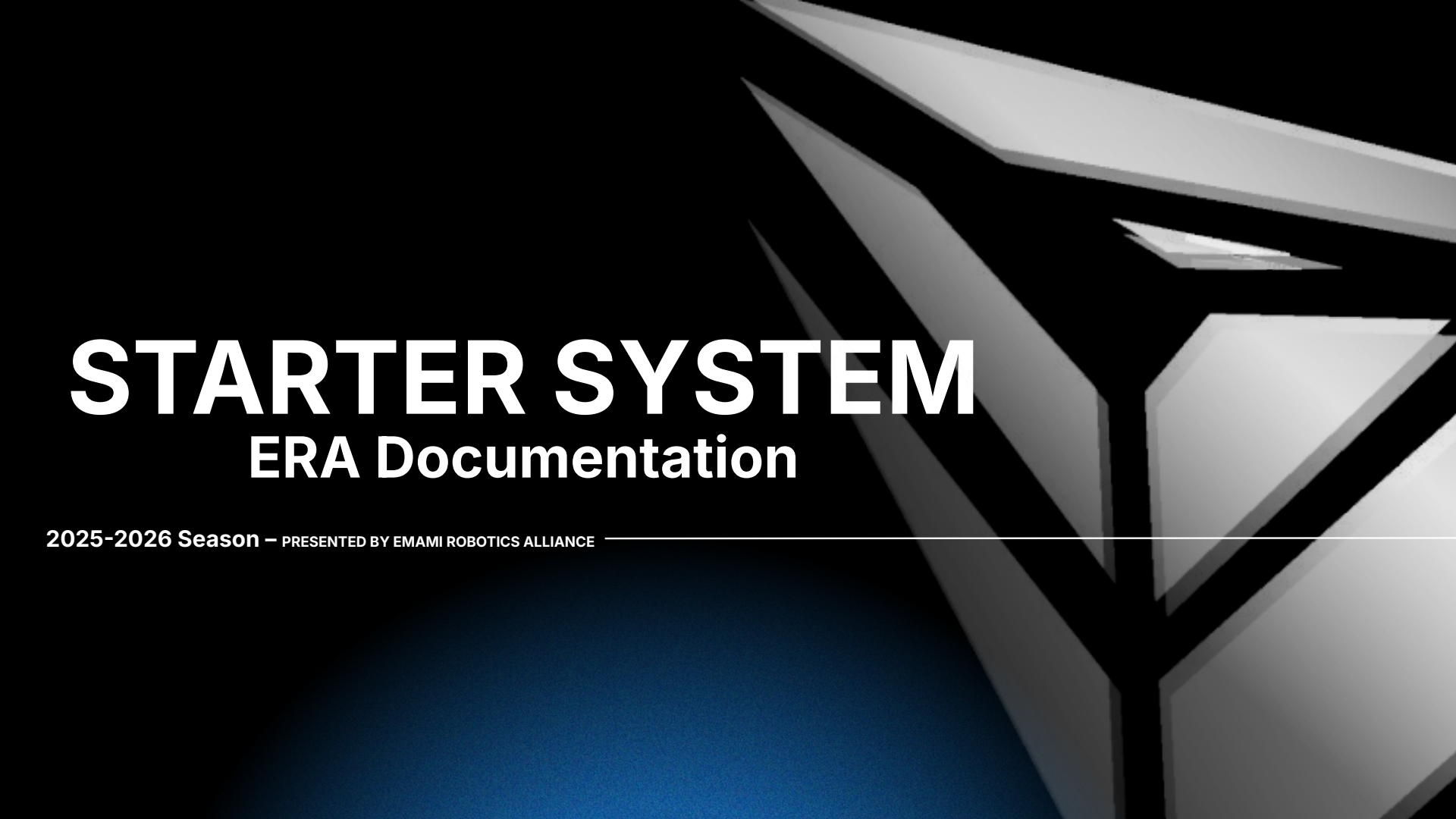




STARTER SYSTEM

ERA Documentation

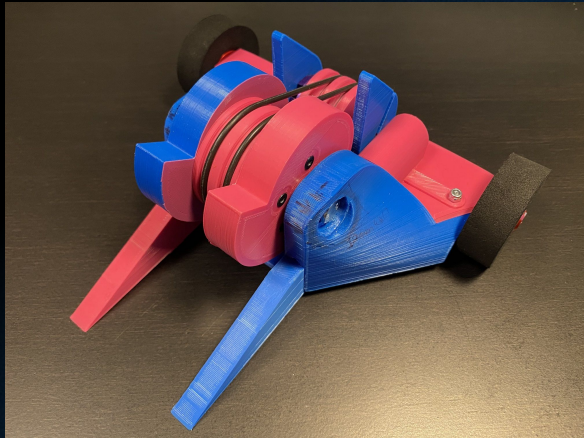
2025-2026 Season – PRESENTED BY EMAMI ROBOTICS ALLIANCE

Robot Overview



What is a 1lb Battlebot?

A 1lb (antweight) combat robot is a small, remote-controlled machine designed to disable or outmaneuver an opponent in a controlled arena.

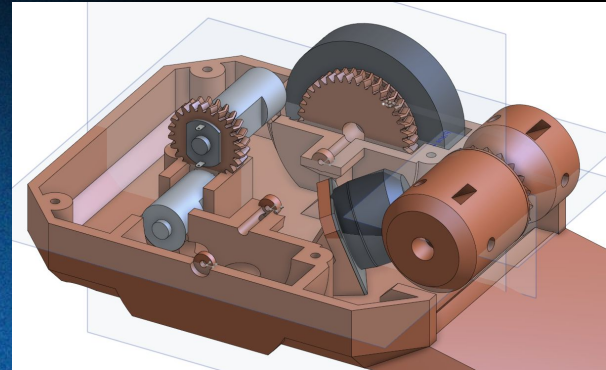


Constraints

Weight: $\leq 1 \text{ lb}$ (454g)

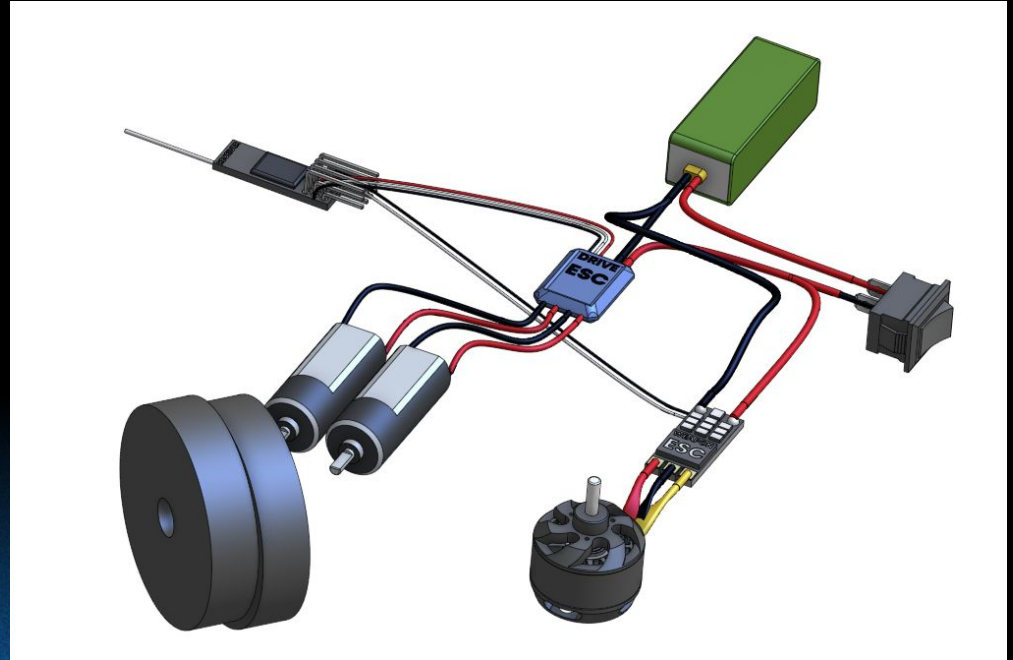
Size: Must fit within an 8in $\times$ 8in $\times$ 8in box at match start

Power: Electric only (no pneumatic / combustion)



Core Subsystems

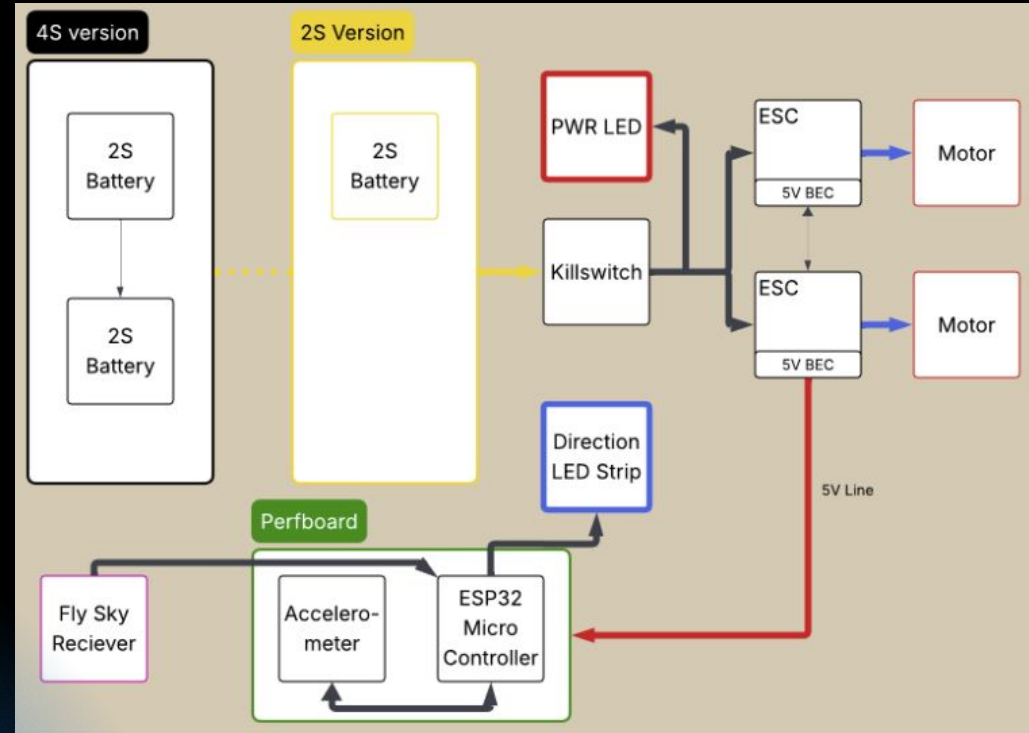
- Drive System
 - 2 motors (left + right)
 - Enables tank steering
- Weapon System
 - 1 motor (spinner, lifter, etc.)
- Electronics
 - Receiver
 - ESCs (Electronic Speed Controllers)
 - Battery
 - Power switch
 - Wiring



Going above and beyond

- While not part of the core kit, teams are allowed to go further and add an ESP32 board to their robot to implement code, however all robots are still limited to 3 motors (2 for navigation, 1 for weapon)

Example: [Donut of DOOM](#)



Mechanical Design Guide



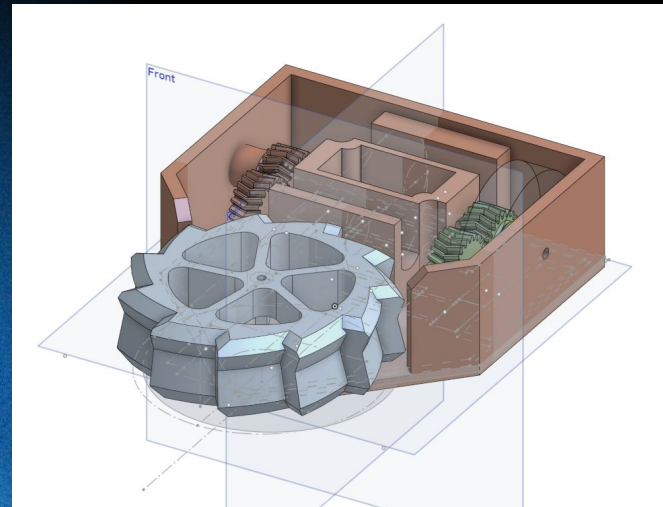
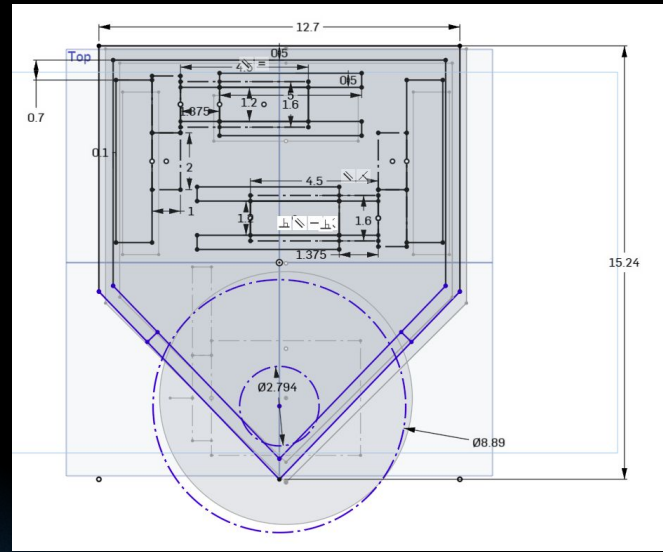
Design Philosophy

- Keep designs simple and modular
- Prioritize low center of gravity to avoid flipping
- Protect electronics using internal compartments
- Design for easy repair between matches
- Ensure robot design follow the ruleset linked below:
[ERA Robot Construction Specifications](#)

Less
Is
More.

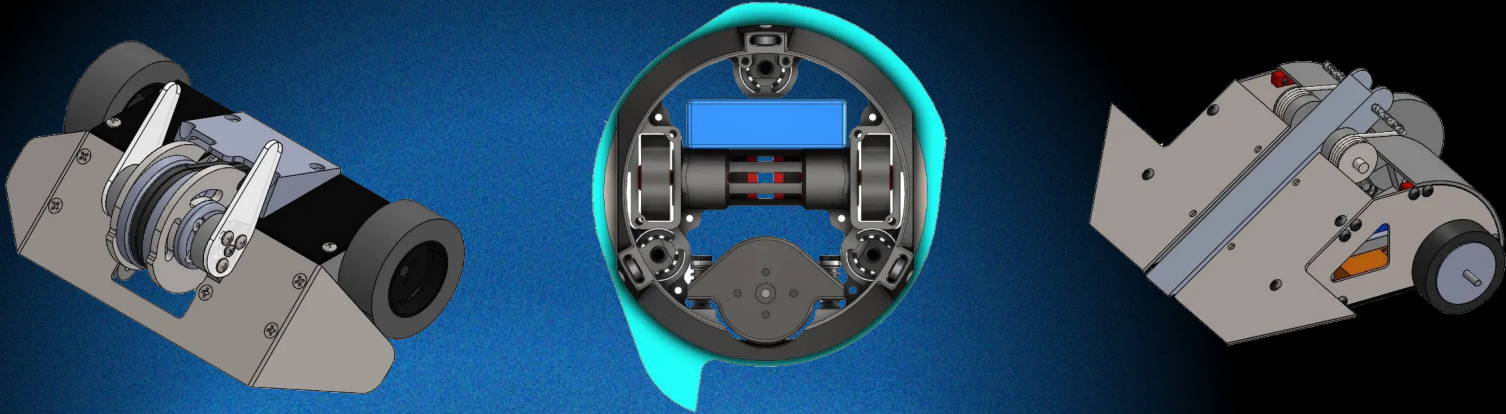
CAD Workflow

- Start with 8×8×8 bounding box
- Place key components:
 - Battery (centered, low)
 - Motors (aligned with wheels)
 - Weapon system
- Sketch:
 - Top view → layout
 - Side view → height + weapon reach
- Add:
 - Mounting holes
 - Wire channels
 - Armor panels

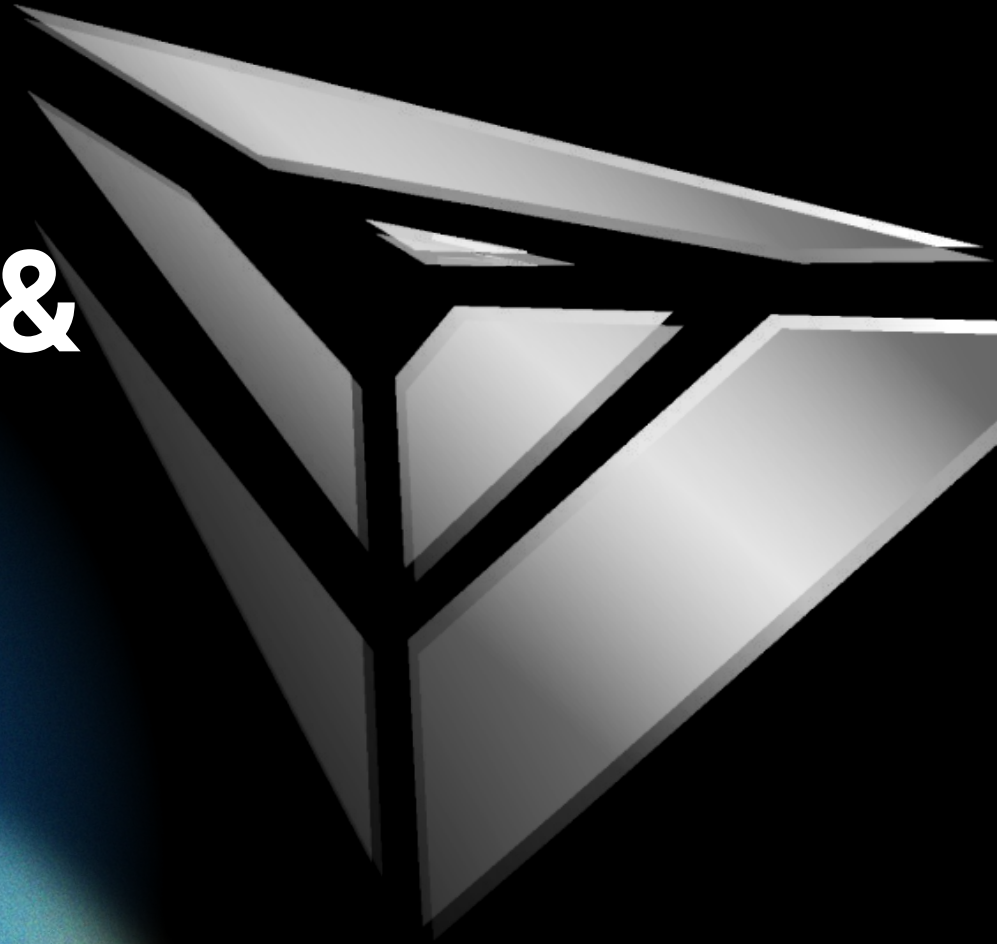


Common Designs

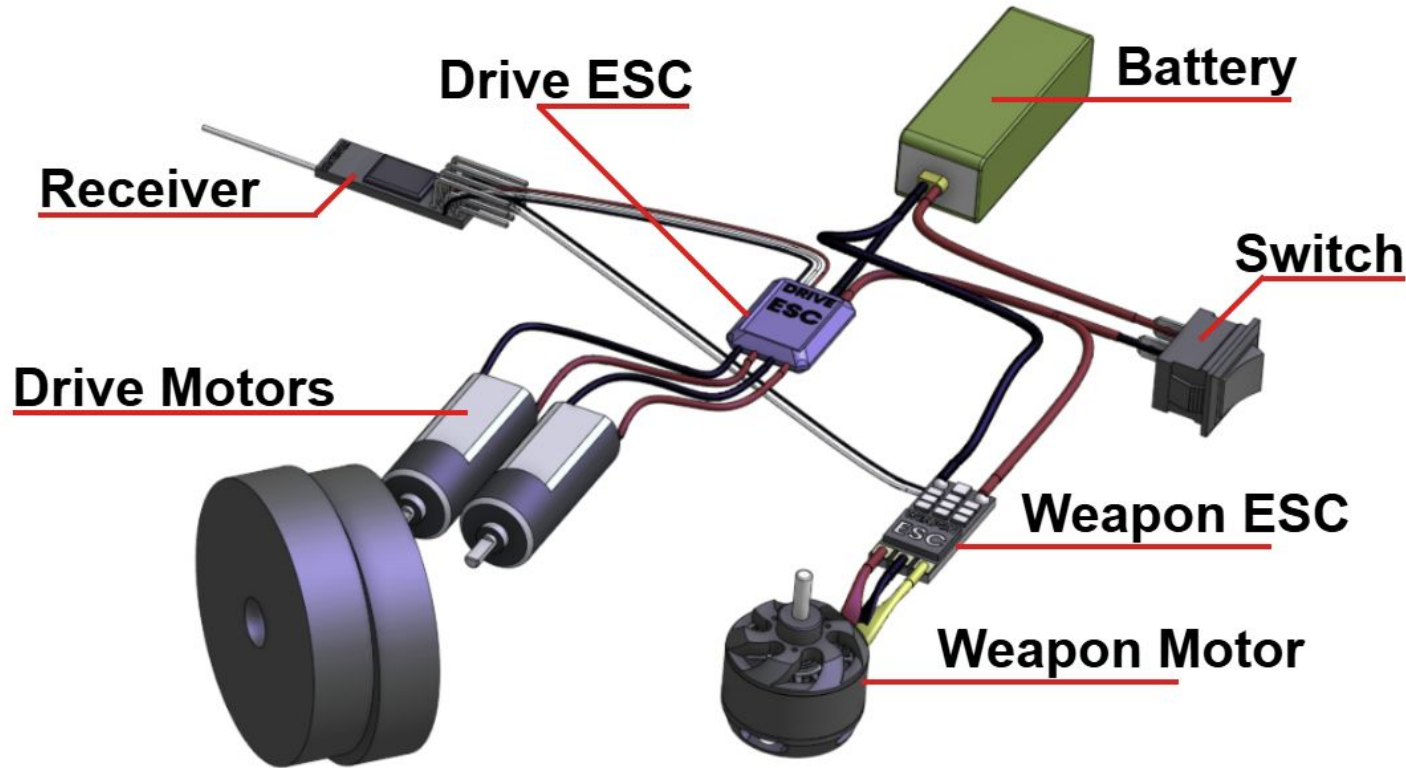
- Wedge Bot
 - Simple, durable, great for beginners
- Spinner
 - High damage, requires balance + safety
- Lifter/Flipper
 - Strategy-focused, harder mechanically



Electronics & Wiring



Electronics Complete System



Weight:

electrical:
34.4 grams

battery:
33 grams

drive motors
55 grams per

weapon
motor:
44 grams

Battery

- An exposed battery is an instant KO
- If you want to be extra, secure the battery
- Should be easily removable for safety
 - You will be replacing the battery every match!
- White connector is for charging



Standard Motors & Servos

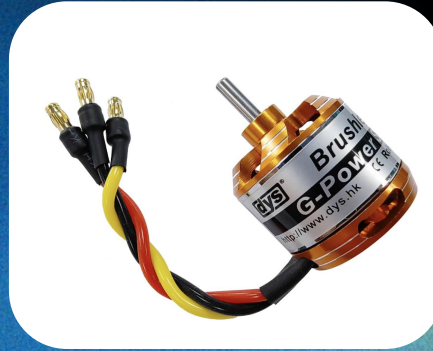
Drive Motor: N20

- Brushed
- 800 RPM at 2S
- 2A+ Stall Current
- Built-In Gearbox



Weapon Motor

- Brushless
- 1000KV or 1400KV
- ~200W Peak Power
- ~30A Peak Draw



Servo

- 13 kg cm at 2S
- 180° range*



ESC Selection

Standard PLANT ESC:

- Brushless
- 30A Continuous
- 2-6s
- NO BEC



Standard PLANT ESC:

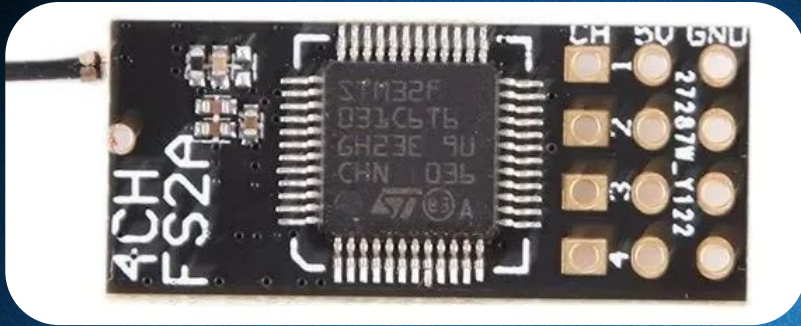
- Brushed
- Dual ESC (controls 2x motors)
- 2A Continuous
- 2-4s
- Includes a BEC
 - Outputs 5V



Standardized Receiver/Transmitter

Receiver: FlySky FS2A

- 4 Channel Receiver
 - Outputs 4 signals
- Requires 5V



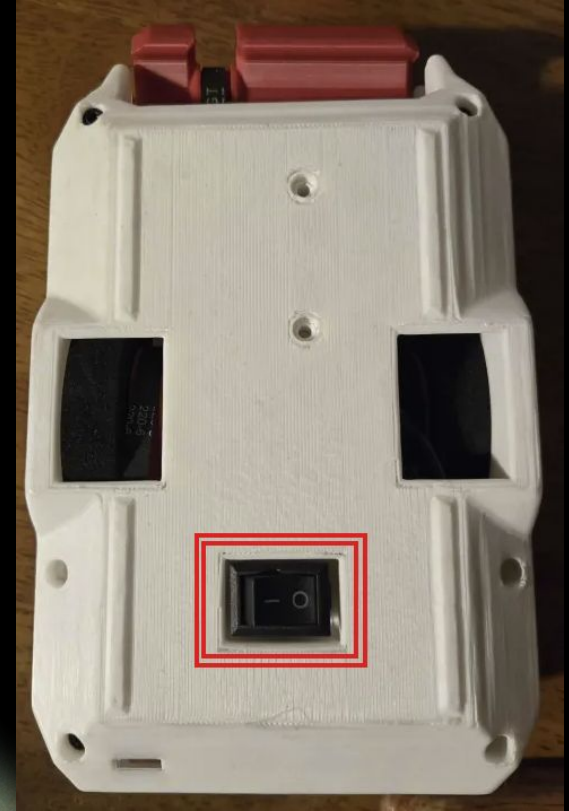
Transmitter: FlySky FSi6X

- 6 Channel Transmitter



Switch

- Should be close to the battery
- Switch must be mounted and secure
- Semi-accessible from the outside of the bot
 - Not to the point other bots can turn it off

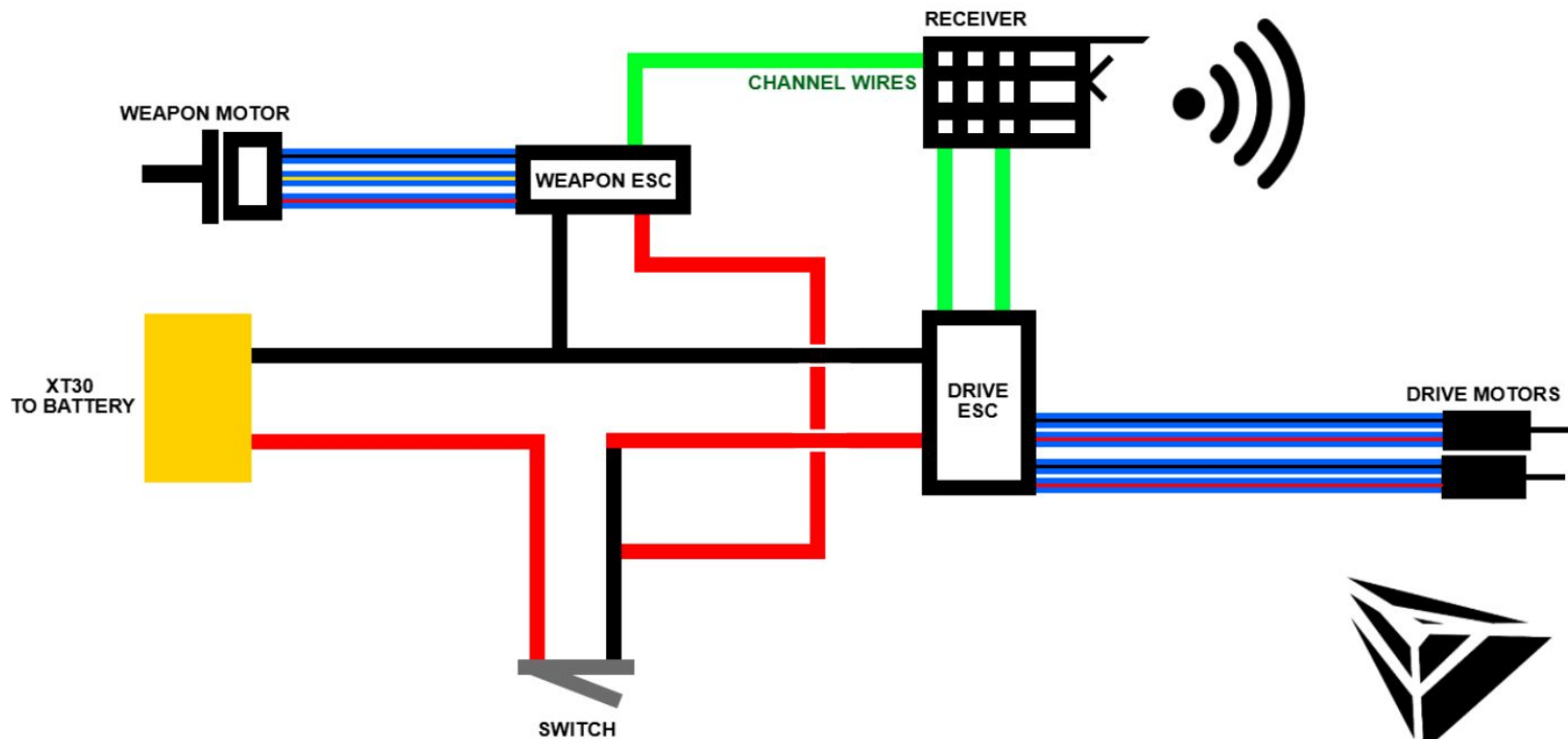


Safety Light

- Required for all bots
- Must be visible from outside
- It shows if robot is on
- Your LED is rated for 3-5V
- Can only be powered one direction

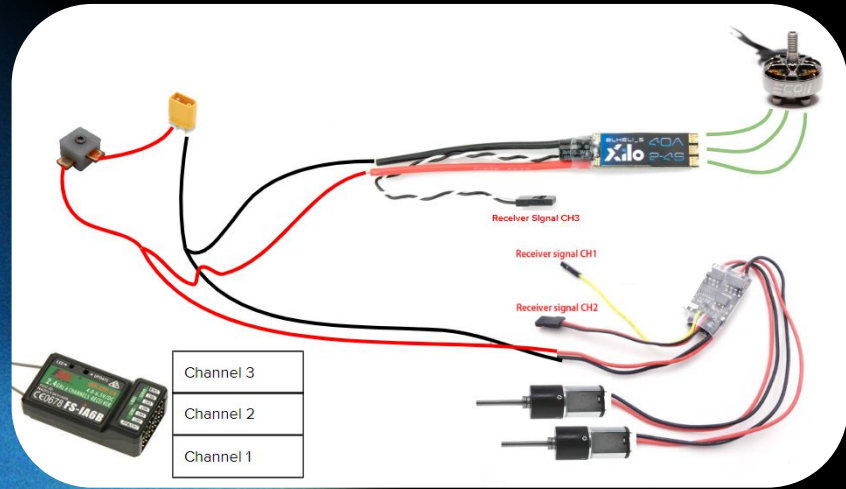


Wiring Guide



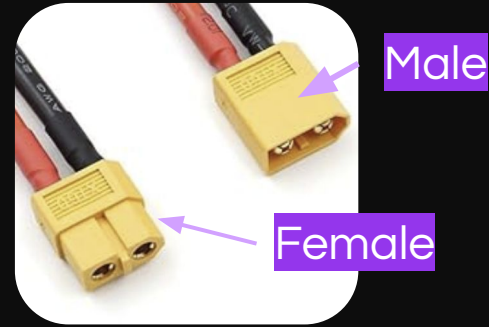
In addition to major component selection, your wiring harness (how all of these different components connect) is very important. This includes:

- Wire Gauge
- Connectors & Insulation
- Protection



Connectors

- XT30/XT60 Connectors
 - Batteries
 - High Current +/- Pairs
 - CHECK if your components have male or female connectors
- Dupont Connector:
 - Signal Wires, 5V, GND



XT30



Dupont

Soldering

Soldering is a method of joining metal parts like wires, connectors, and circuit boards by melting a filler metal (solder) with a hot iron. The molten solder flows into the joint via capillary action, creating an electrical connection upon cooling.

Think of it like conductive hot glue!



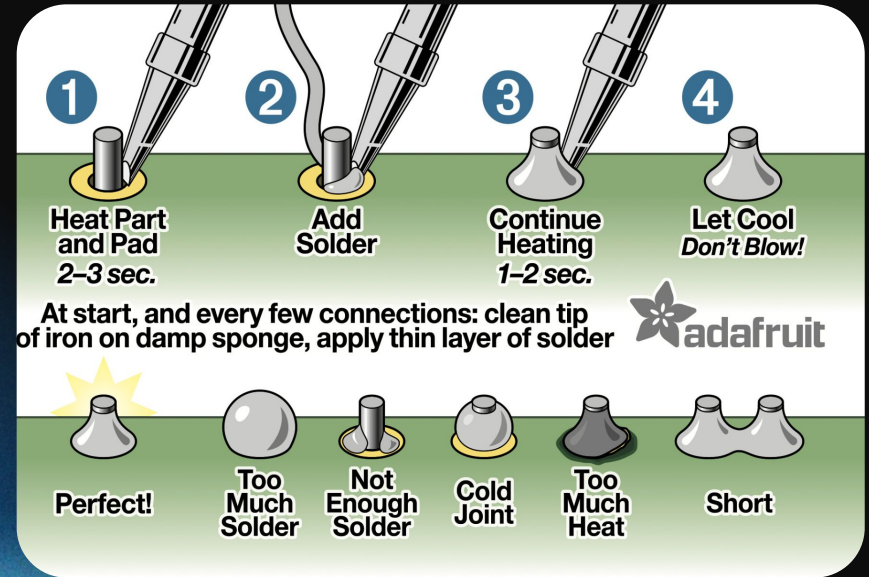
Tools

- **Soldering Iron:** Tool that provides directed heat.
- **Solder:** Metal alloy that creates joints.
- **Sponge:** Cleans oxidation from iron tip.
- **Flux:** Chemical cleaner for better flow.
- **Wire Strippers:** Removes insulation without damaging wire, exposing the wire



How to Solder

0. Clean & Tin Tip
1. Heat wire & connector
2. Add solder
3. Continue heating until solder flows
4. Let it Cool
5. Apply heat shrink / electrical tape



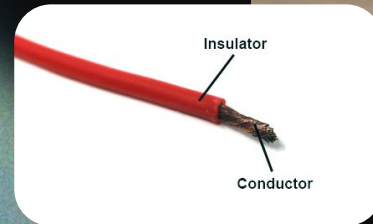
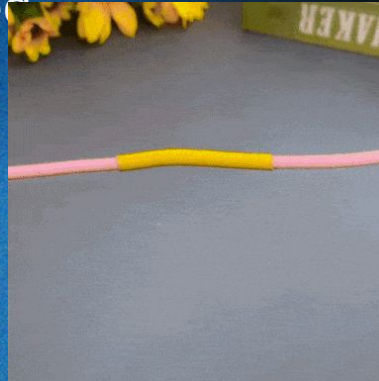
Tips & Good Practices

- Heat the copper, not the solder
 - Solder will *flow* into the hot joint!
- Keep the iron around 330°C - 350°C
- Keep your iron clean; frequently wipe off old solder on your sponge or brass wool
 - Don't forget to wet your sponge first!
- Keep your iron tinned
- Pre-tin your components
- Use flux to clean the joint before soldering
- For soldering connectors with plastic housings like XT30s, connect a pair of XT30s together to prevent the housing from deforming with heat
- Do a tug test once your joint cools!
 - [How To Study for Tug Test](#)



Safety

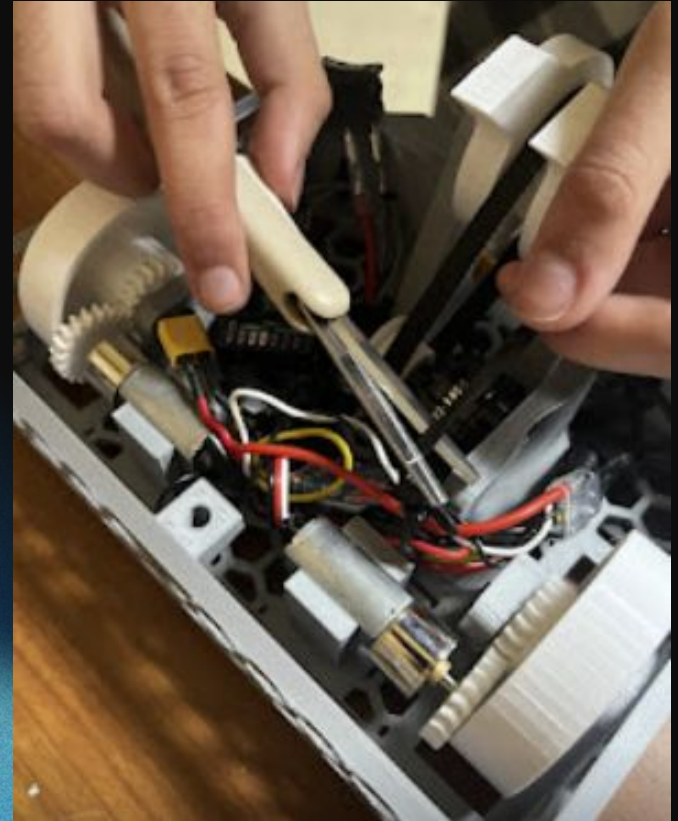
- Soldering iron will transfer heat to all nearby components and heat
- Do not inhale solder fumes
- Always solder near a window and use a fan/fume extractor
- ELECTRICAL TAPE EVERYTHING
- There should be no exposed conductors at all
- Prevent shorting



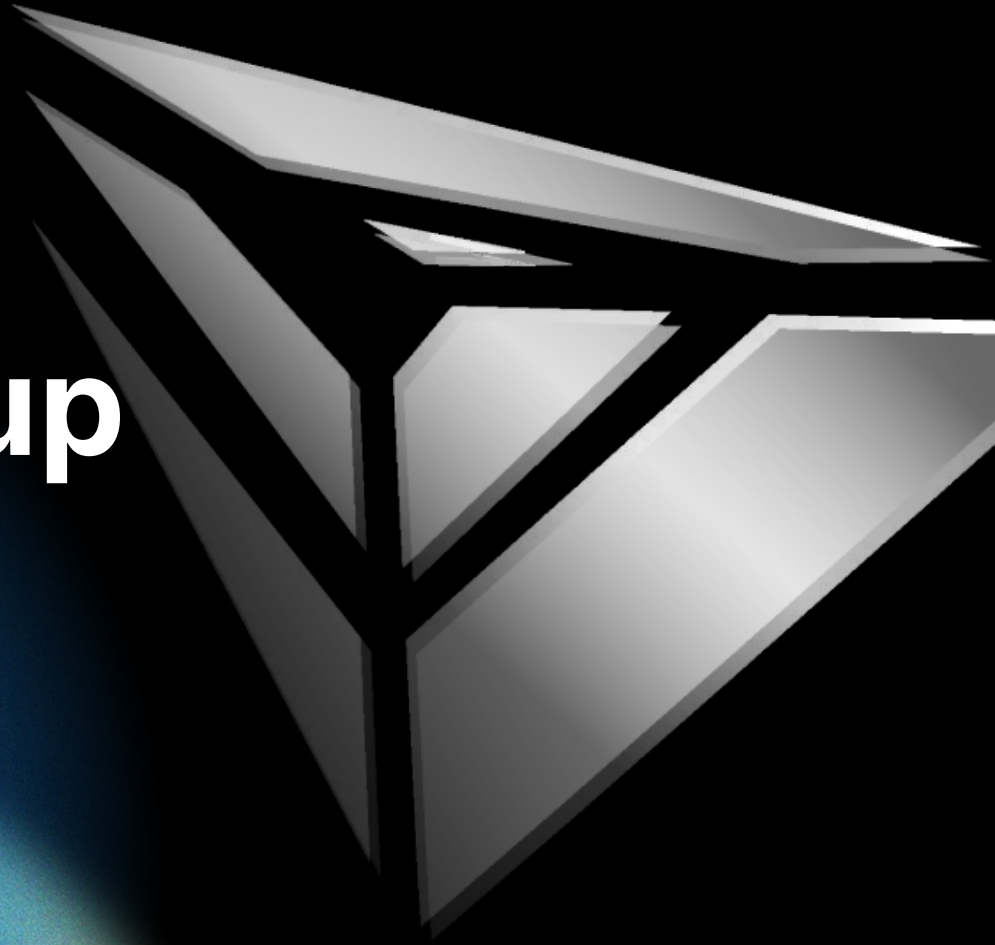
Electrical Checklist

Block Diagram and Layout

- Specify Components and Connectors
- Color Positive, Negative, and Signal Wires
- Include how your electronics are placed inside frame
 - Account for wire bend, bulky connectors
 - Account for brushless motors
 - Minimize zig-zagging
 - Minimize distance between components
 - Switch, motors, servos are only things mounted



Controls & Receiver Setup (FlySky)



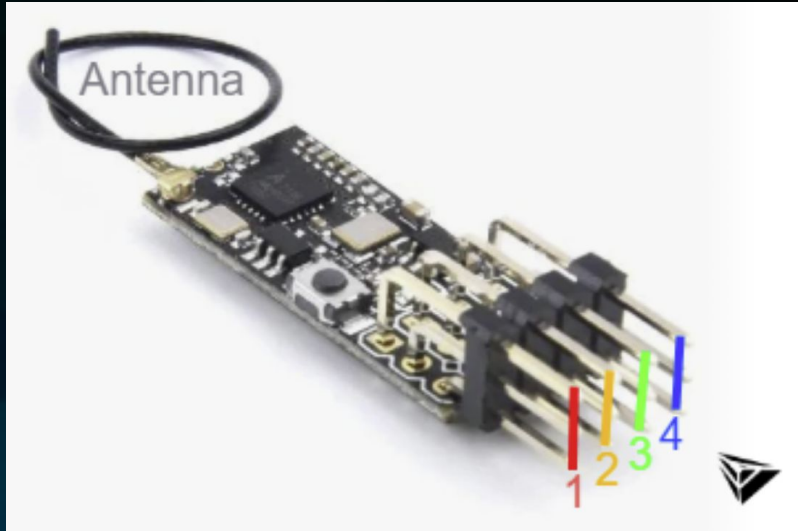
Controller

We will be using the Flysky FS-I6X controller



Channel Mapping Logic

Channels are defined by the pins on the receiver.
Each set of 3 Pins = 1 Channel
Each Channel = 1 Motor movement



1 Channel = 1 Motor

MOTOR 1 --> Joystick 1 (+x..-x) --> Channel 1
MOTOR 2 --> Joystick 1 (+y..-y) --> Channel 2



Setting up the Controller

Setup Steps

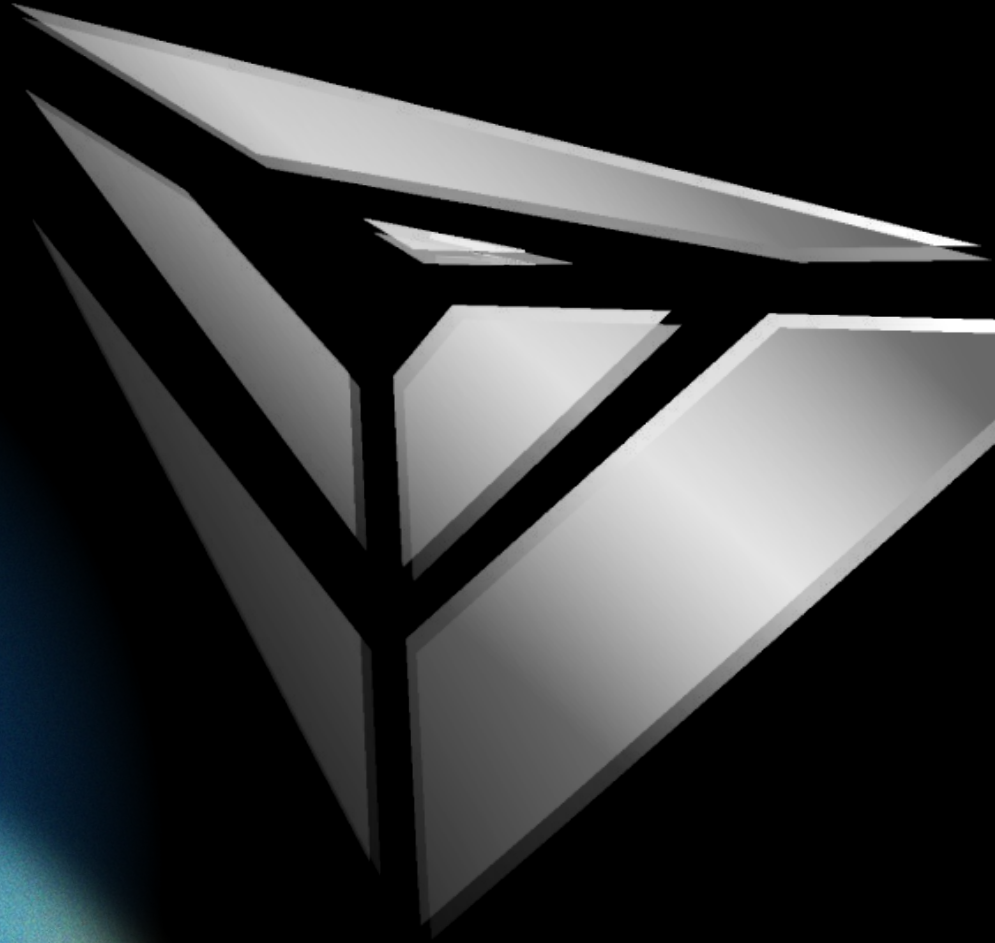
1. Bind transmitter to receiver
2. Plug ESC signal wires into correct channels
3. Enable mixing (tank steering)
4. Reverse channels if needed

[Click here for tutorial](#)

Testing Protocol

- ALWAYS test drive without weapon active first
- Elevate robot when testing weapon
- Keep hands clear

Build Checklist



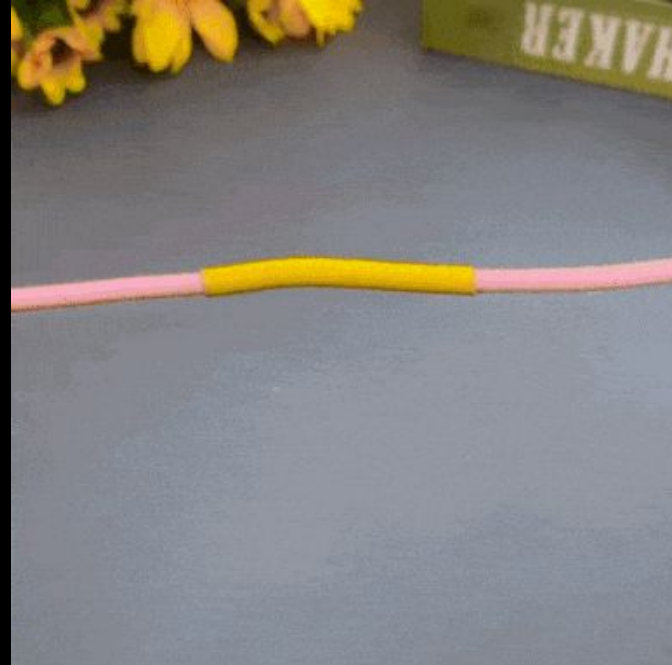
Build Checklist

Before Power-On

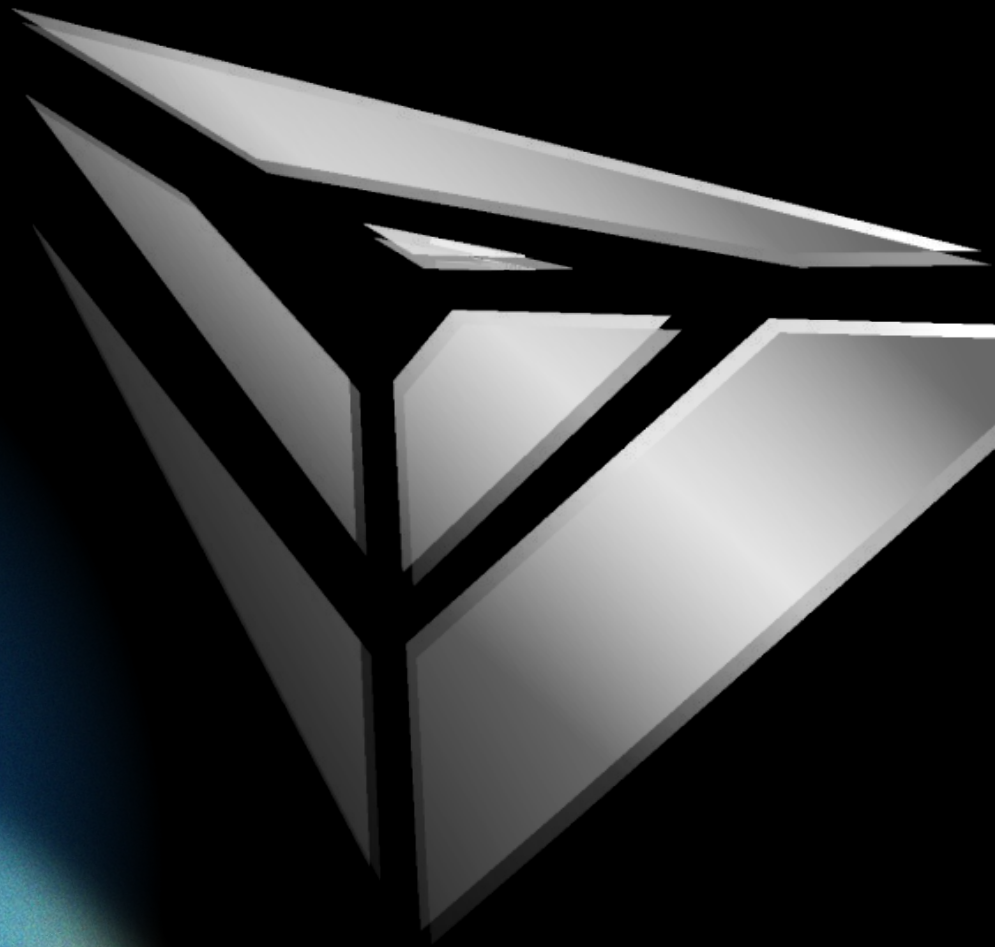
- Wires insulated (no exposed metal)
- Battery secured
- No loose screws
- Weapon spins freely

First Test

- Wheels spin correct direction
- Robot drives straight
- Weapon activates properly
- No overheating or smoke



Game Rules



Overview (Based on SPARC)

Match Format

- 1 vs 1
- Duration: 2–3 minutes

Judging Criteria

- Damage
- Control
- Aggression

Win Conditions

- Knockout (KO): opponent cannot move
- Judges Decision

Core Rules

- No pinning > 5 seconds
- No intentional entanglement
- Robots must pass safety inspection

Construction Rules

Found Here



ERA CONSTRUCTION SPECS & RULESET

Based on SPARC Robot Construction standards.

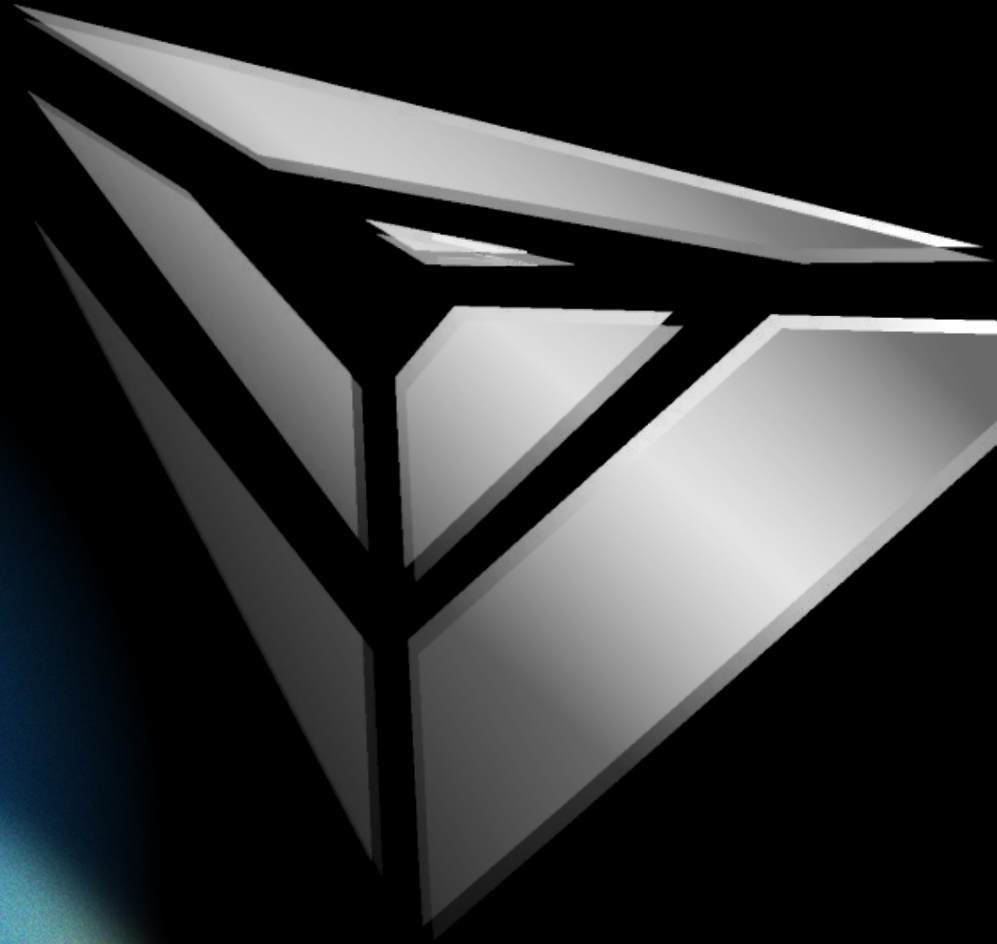
1. Overview and Purpose

- 1.1. The SPARC Robot Construction Specifications were created to provide both builders and event organizers with an up-to-date and easy-to-implement ruleset.
- 1.2. The SPARC Standard Ruleset will call out areas where the rules are often altered by the events and will provide the most frequently used options for easy adaptation.

2. General

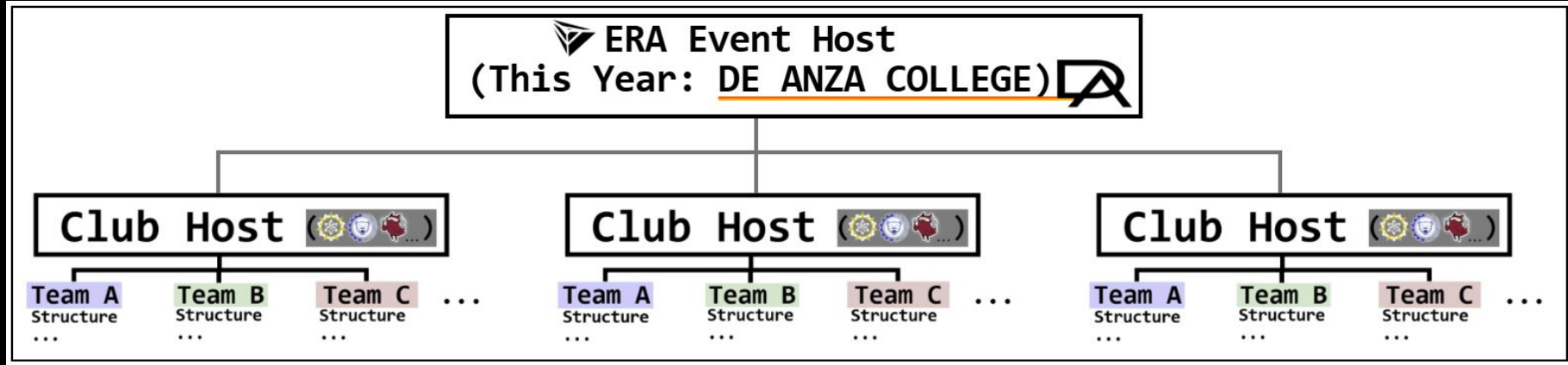
- 2.1. All participants build and operate robots at their own risk. Combat robotics is inherently dangerous, regardless of scale. No amount of regulation can encompass all the dangers involved. Please take care not to hurt yourself or others when building, testing, and competing.
- 2.2. If you have a robot or weapon design that does not fit within the categories outlined in these rules or is in some way ambiguous or borderline, please contact ERA. 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.
- 2.3. 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.

Team Leadership Section



Overall Organization

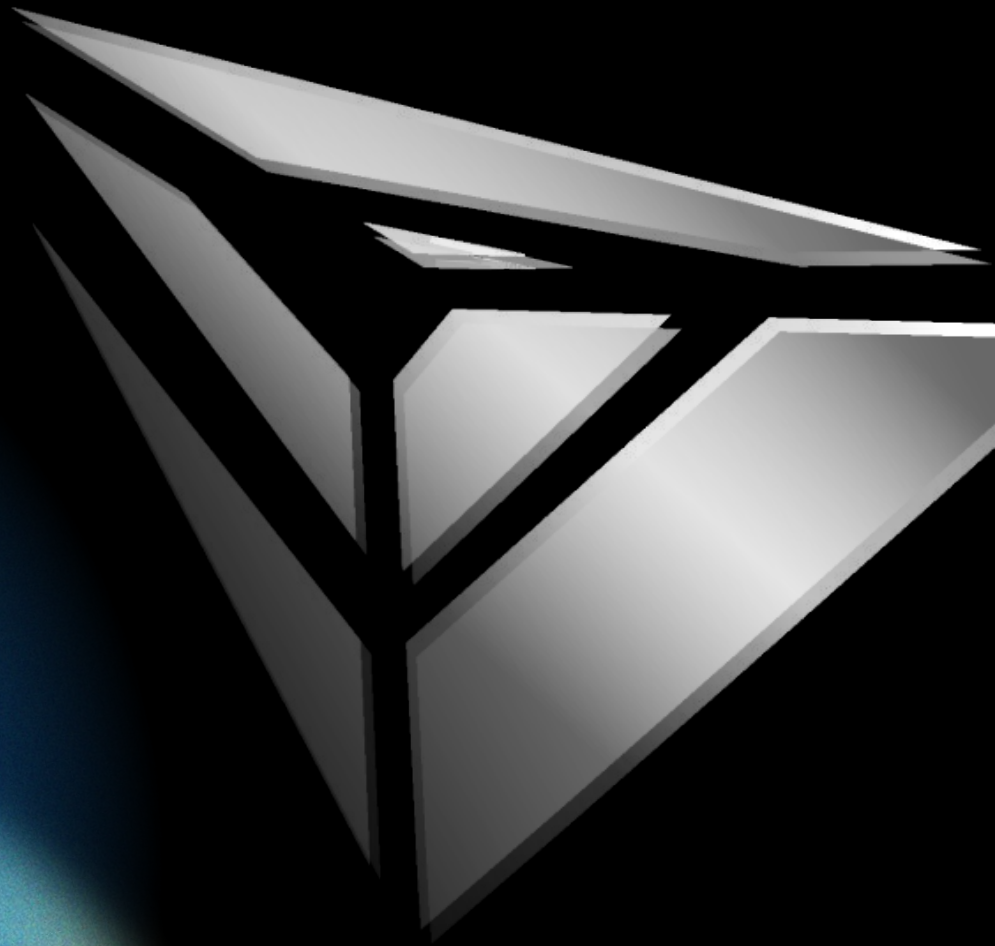
- Each Club Host can be represented by multiple teams
- One Robot per team



Team Key Roles (At the discretion of hosting club)

- **Team Captain (Official Leader for the conception of the robot)**
- **CAD Lead (preferably proficient in Fusion/Onshape)**
- **Electronics Lead**
- **Driver**
- **Strategy Lead**
- ...
- **Keep in Mind: Motivation > Skill**

How to Deliver It



Team Representation

Teams can pick a name for their robot and be represented by that name.

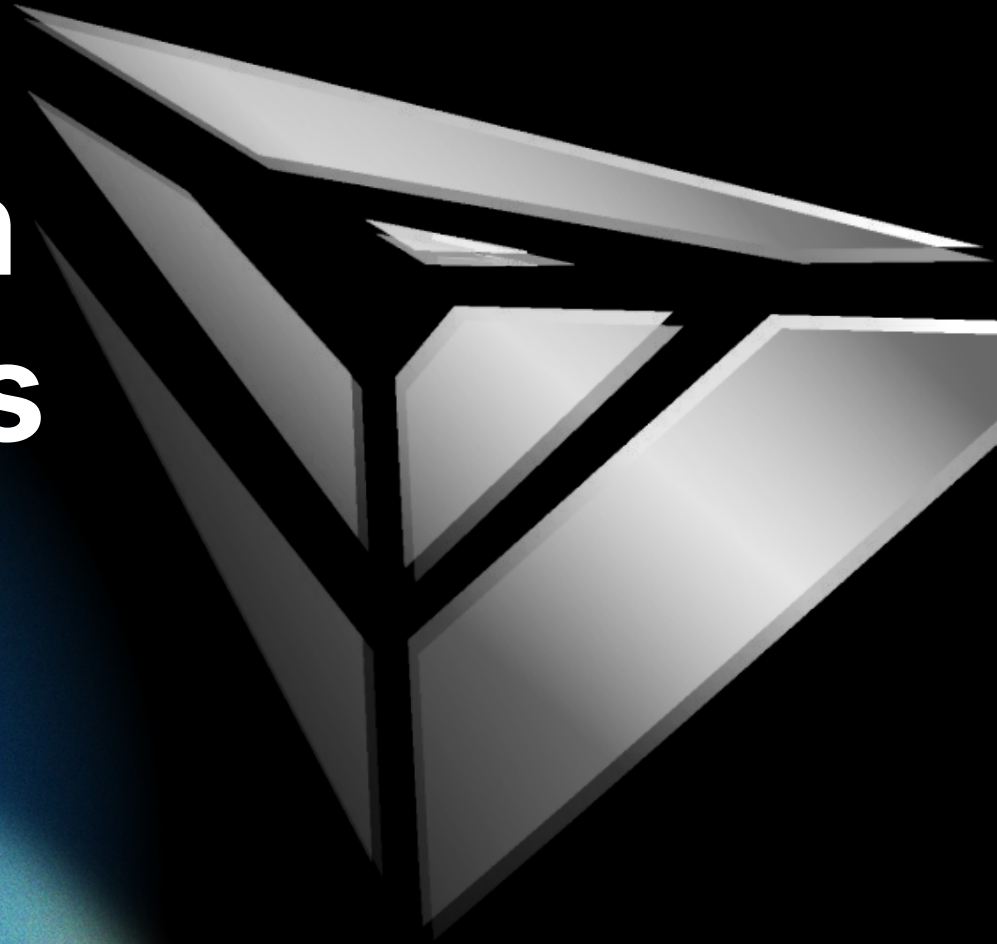
To present your robots, each team will be required to produce a portfolio slideshow going over their design process from concept to reality.

These portfolios may be presented to sponsors and will represent your work. All presentations must be shared with: erallianceinfo@gmail.com

- Examples (from Berkeley CRB):

<https://docs.google.com/spreadsheets/d/1tA7es8FHwINd1u8AC2RUT7T6UeAnlsz6XrZ2ZYv7DSQ/edit?gid=0#gid=0>

Competition Expectations



What to Bring

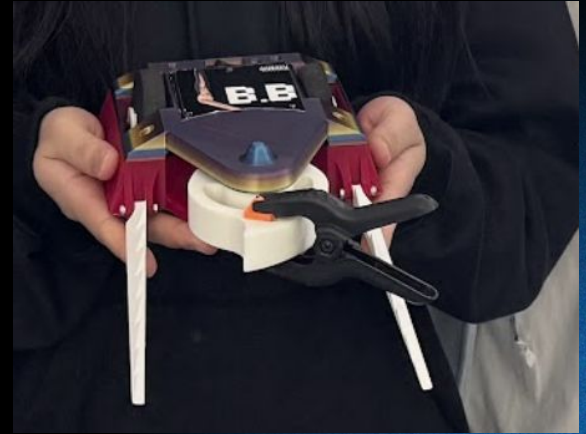
- **Safety goggles (REQUIRED in pit + arena areas)**
- Fully charged batteries + backup
- Spare parts:
 - a. Motors
 - b. ESCs
 - c. Extra wiring
 - d. Fasteners ...
- Tools:
 - a. Screwdrivers
 - b. Hex keys
 - c. Soldering iron ... (will also be provided at comp)

Pit System

- Each team will have a designated pit area
- This is where:
 - a. Repairs happen
 - b. Batteries are changed
 - c. Adjustments are made

Expect a fast-paced environment between matches

- Safety goggles must be worn AT ALL TIMES in:
 - Pit area
 - Arena proximity
- **Weapon locks or power OFF required when not in match**



Questions?
erallianceinfo@gmail.com





HOSTED BY DE ANZA COLLEGE