# THE ROBONAUTS

## 2023 TECHNICAL BINDER


2023

# TABLE OF CONTENTS

## INTRODUCTION



## II. ECHO


## OVERVIEW

The Robonauts were founded 27 years ago, based on a partnership between NASA's Johnson Space Center and Clear Creek Independent School District. During the 2023 season our team of 66 students and 19 mentors competed at 6 events during the official Charged Up season.

## ROBONAUTS' GOALS

1. Educate our students in the field of engineering
2. Engage our community in engineering and STEM education
3. Field a competitive team
4. Grow and nurture the Robonauts' Family

# SEASON STATISTICS

## 104 MATCHES PLAYED

Most of any team during the 2023 official season

## 117 UNIQUE ALLIANCE PARTNERS

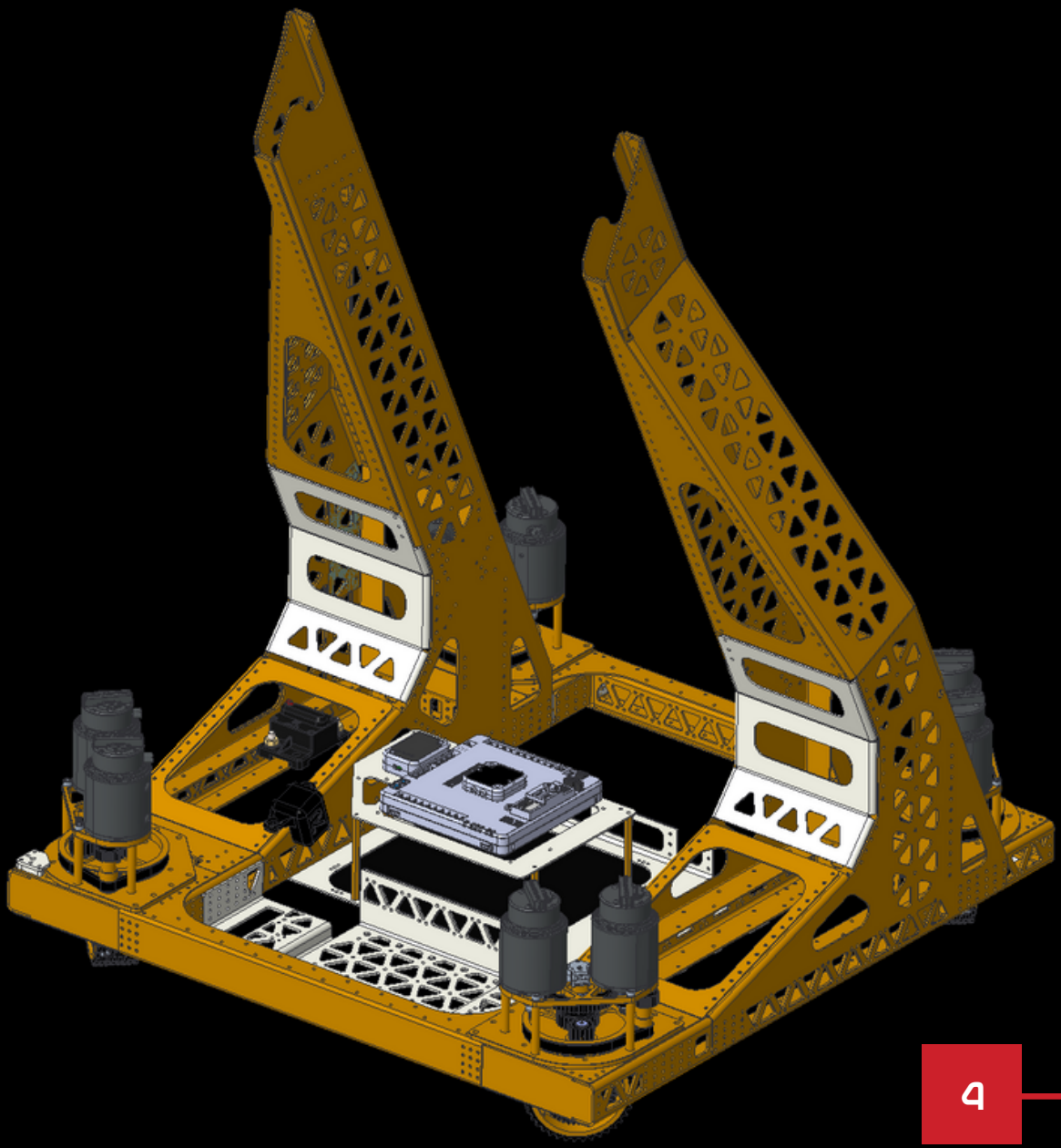
## 7 BLUE BANNERS

ECHO


BUILT FOR THE 2023 FIRST ROBOTICS COMPETITION GAME "CHARGED UP"

# CHASSIS

- *26" X 26" Frame*
- *Custom Sheet Metal and Billet Chassis*
- *Swerve Drive Specialties Mk4 Modules*
- *Modules Mounted “Backwards” to Increase Robot Footprint for Greater Stability*
- *L2 Gear Ratio*
- *1/16" Aluminum Sheet Metal Superstructure*
- *Stainless Steel Ballast Plate to Lower Center-of Gravity*

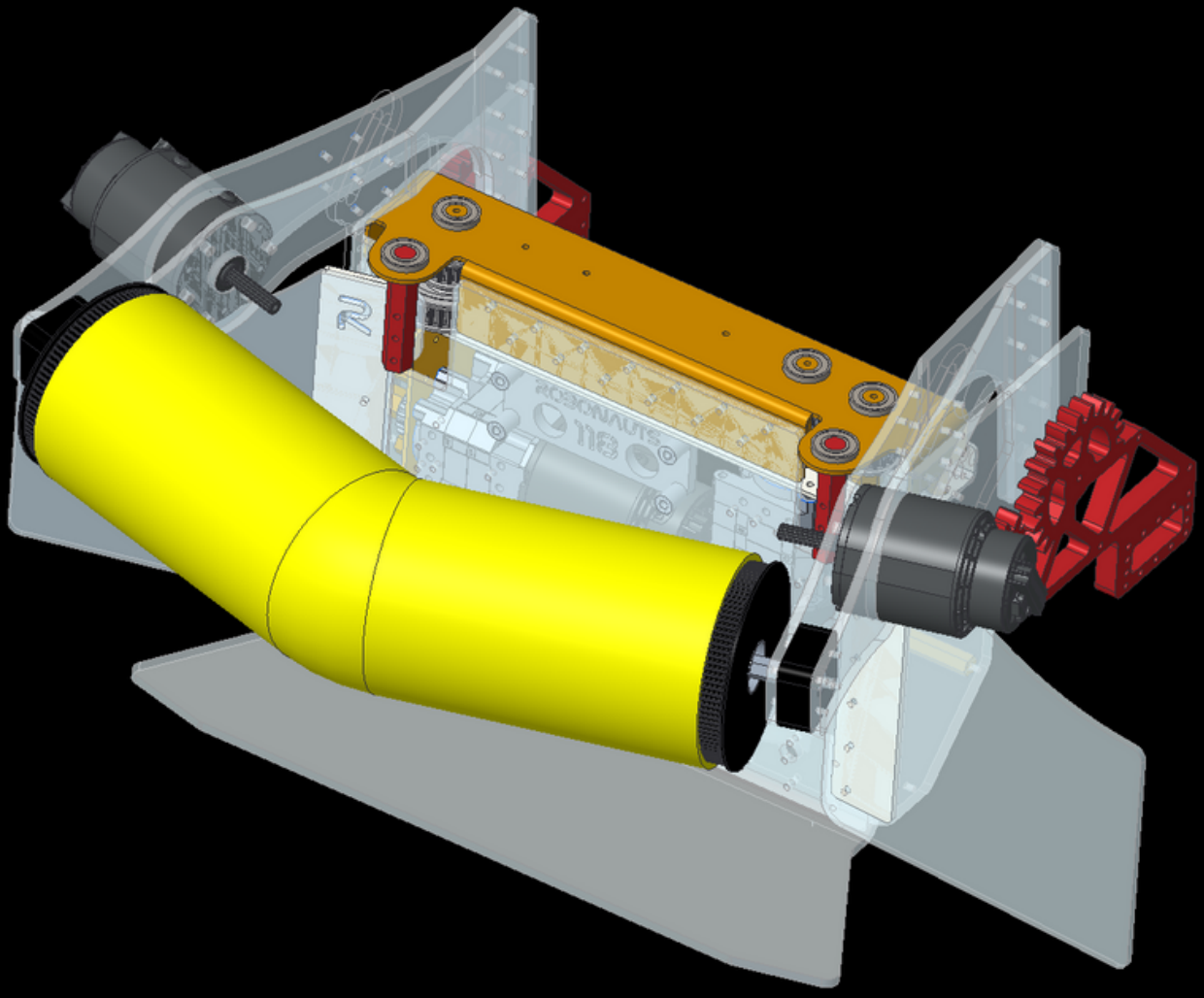


# ARM

- *118:1 Falcon 500 Driven Pivot*
- *15.58:1 Falcon 500 Driven Telescope*
- *Shimmed Hex Interfaces to Minimize Backlash*
- *0.040" Aluminum Sheet Metal Construction*
- *Lightweight Carbon Fiber Telescope Tubes*
- *Extensive Use of Markforged Printed Components*

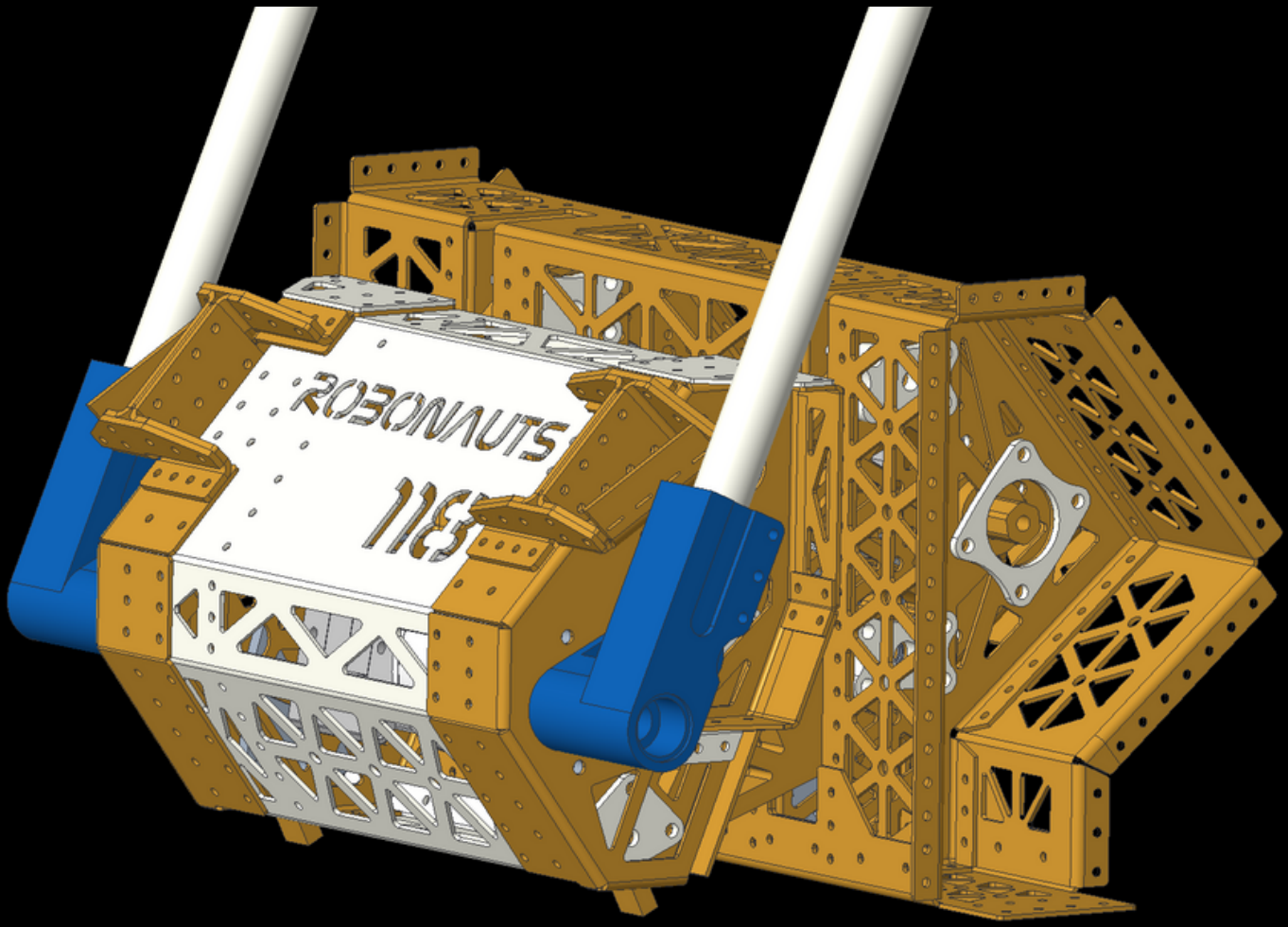
# INTAKE

- *Vector Roller + Dustpan Intake*
- *Custom Waterjet Grout Sponge Wheels over Pool Noodle Roller*
- *6.25:1 Double Falcon 500 Driven Intake Roller*
- *60:1 Falcon 500 Driven Intake Pivot*
- *40:1 Falcon 500 Driven Cone Centering “Flappers”*
- *Cone Detection Camera*
- *Waterjet Sector Gears for Intake Deploy*
- *Bent Polycarbonate Construction for Impact Resistance*



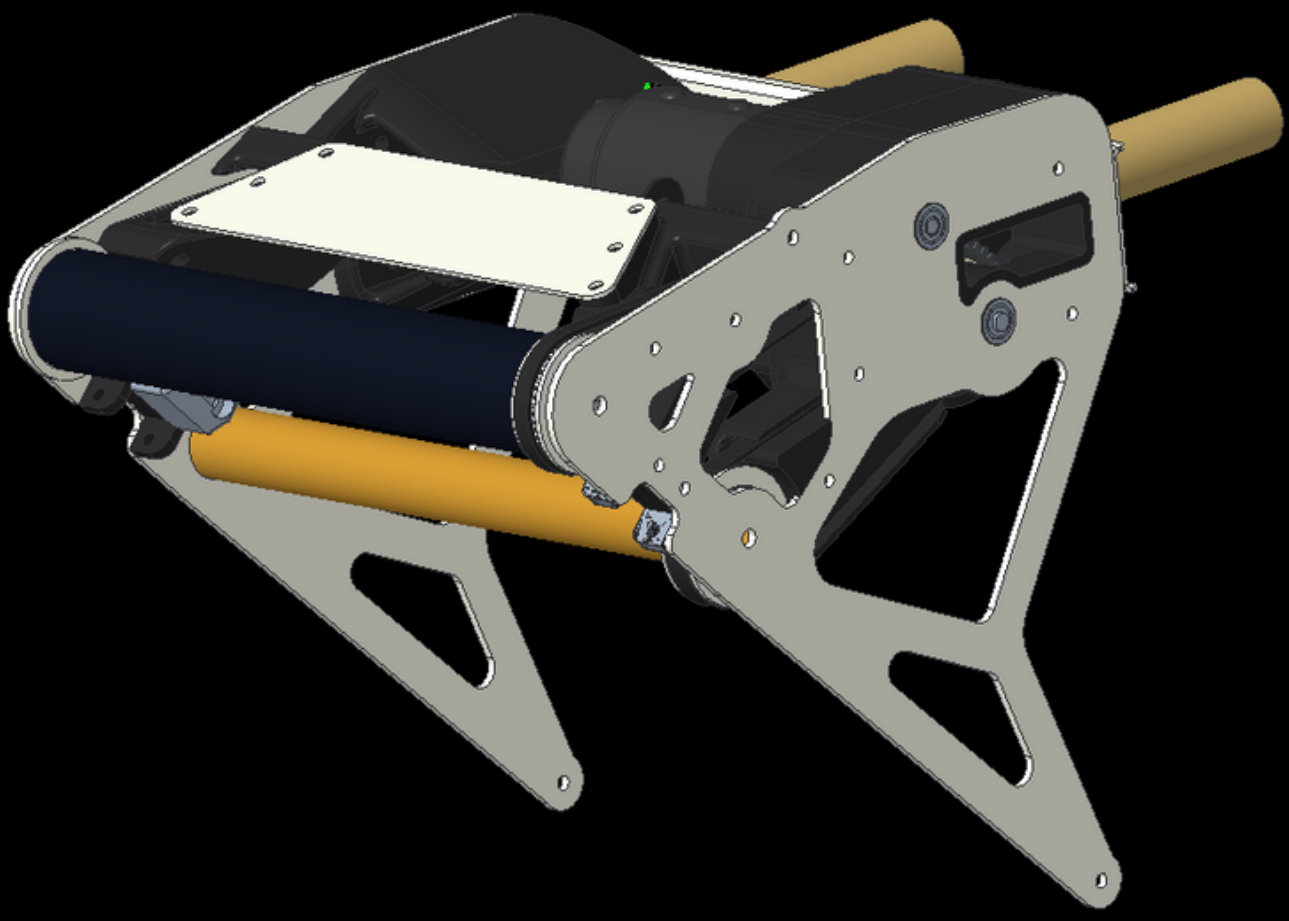
# FORKS

- *3/4" Solid Carbon Fiber Rods to Fit Under Alliance Partner*
- *Non-Parallel Four-Bar Linkage to Lift and Tilt Robot Away from Floor*
- *230:1 Falcon 500 Driven Lift*
- *28:1 Falcon 500 Driven Fork Deploy*
- *Driver Feedback Camera for Alignment*
- *CNC Machined Over-Center Linkage for Fork Deploy*
- *1/16" Aluminum Sheet Metal Structure for Lift Carriage*
- *Servo Driven Ratchet Pawl Release*



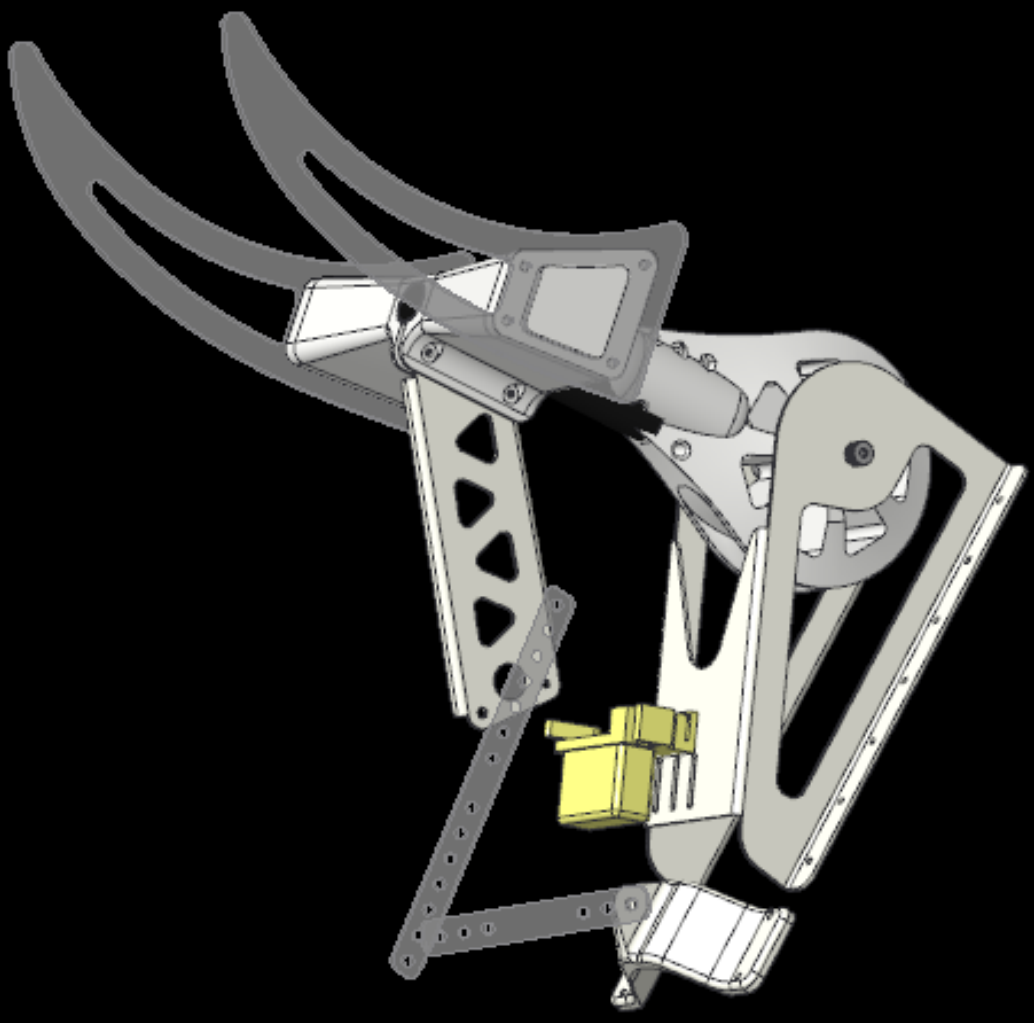
# END EFFECTOR

- *Double Rollers Driven by a Falcon 500*
- *Rollers are Dead Axle Carbon Fiber Tubes to Minimize Weight*
- *3D Printed Clamps to Attach End Effector to Arm Telescope*
- *Rollers Covered in High Temperature Silicone Tubing*
- *Primarily Plastic Structure to Save Weight*



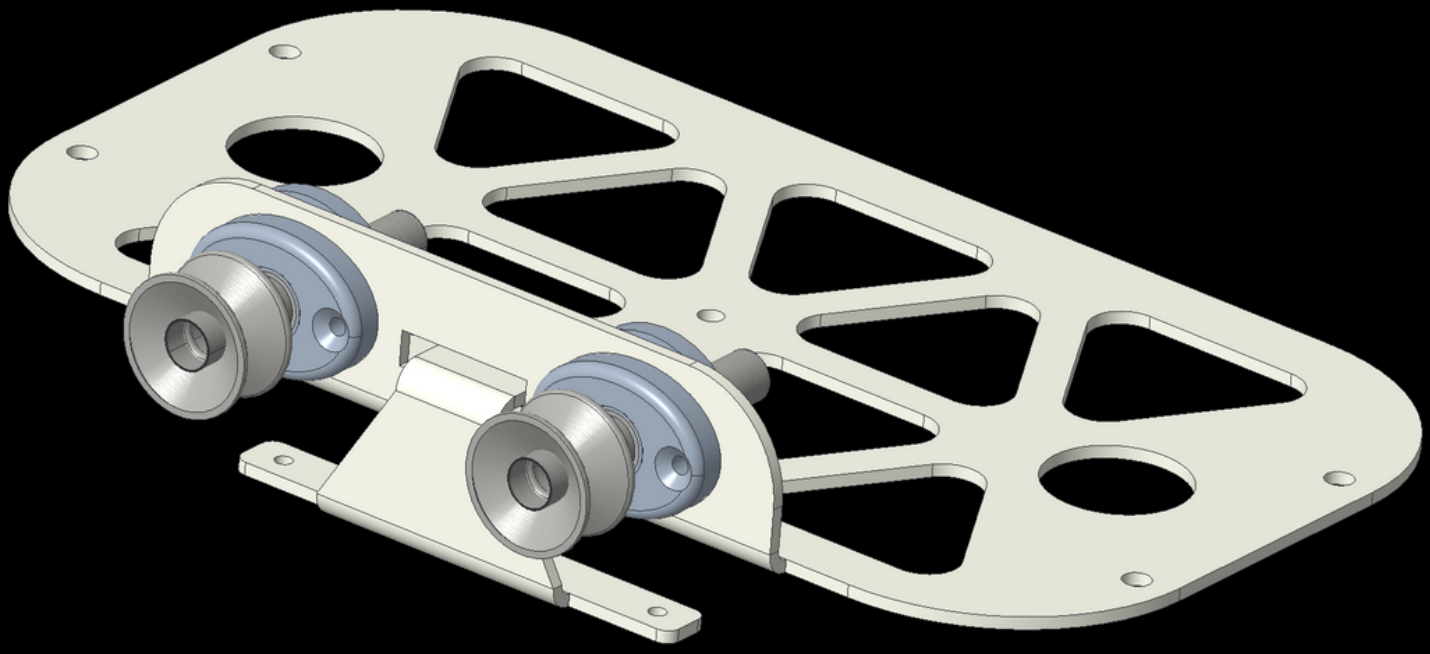
# "BLOOPER"

- *Single Use Catapult for Match Pre-Load Cube*
- *Adjustable Extension Spring for Launch Power*
- *Servo Driven Pin-Puller Release*
- *Adjustable Hard-Stop Linkage*
- *100% Accuracy at Championship Events*



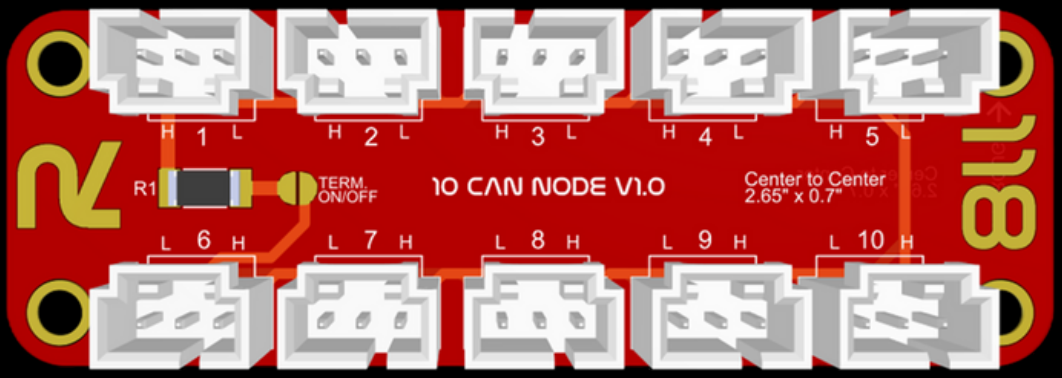
# "SWIPER"

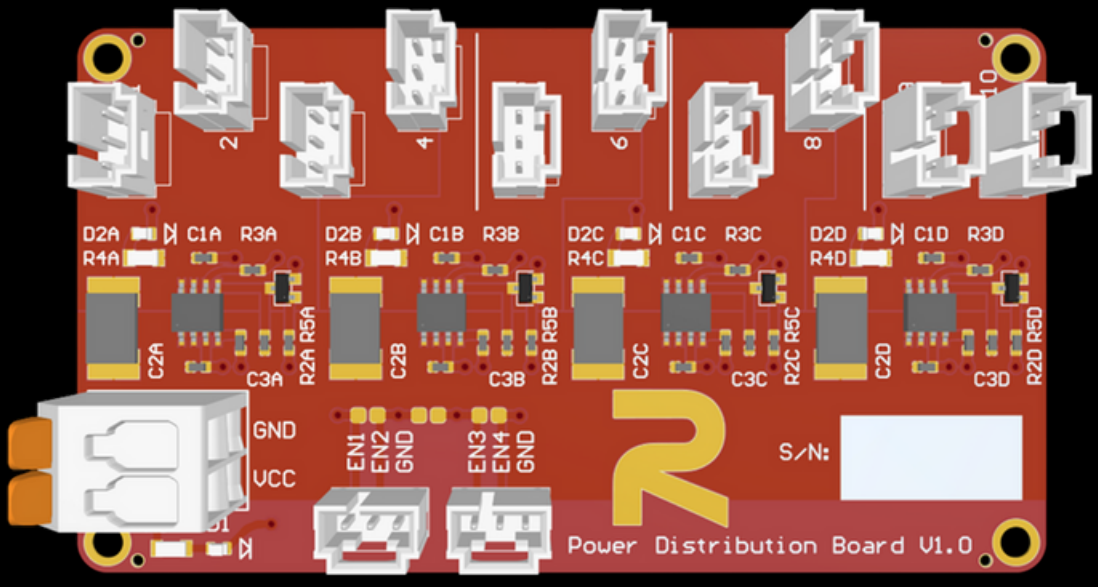
- *Dual Suction Cup Cube Intake*
- *Suction Cups Mounted Within Frame Perimeter*
- *Used for "Swiping" Cubes from Opponents Loading Zone*
- *Each Suction Cup Connected to their own Vacuum Pump*
- *COTS Vacuum Pumps Driven by 775 Redline Motors*
- *Developed in 3 Days Between the Houston District Event and the Space City District Event*



# AVIONICS

- *10 Channel CAN Node*
  - *Custom CAN Bus Board to Implement Star Topology*
  - *One Channel Per Device*
  - *Optional On-Board Termination*
- *Intelligent Power Distribution Unit*
  - *Power Distribution to Low-Current Devices (CANcoders, Limelight, Pigeon, etc.)*
  - *4 Switchable Channels using roboRIO DIO Ports*
  - *Short-Circuit Protection*
  - *Over-Current Protection*
  - *Over-Temperature Protection*
  - *Soft-Start for Current Inrush*



# SOFTWARE

- *Robot Programmed in C++*
- *Lua Scripted Autonomous and Driver Sequences*
- *Team Developed Swerve Code and Path Planning*
- *Autonomous Charge Station Balancing using Gyro PID Algorithm*
- *Hybrid Driver/Autonomous Commanding*
  - *Driver Controls Translation*
  - *Vision Tracking Camera Controls Orientation when Locked On*