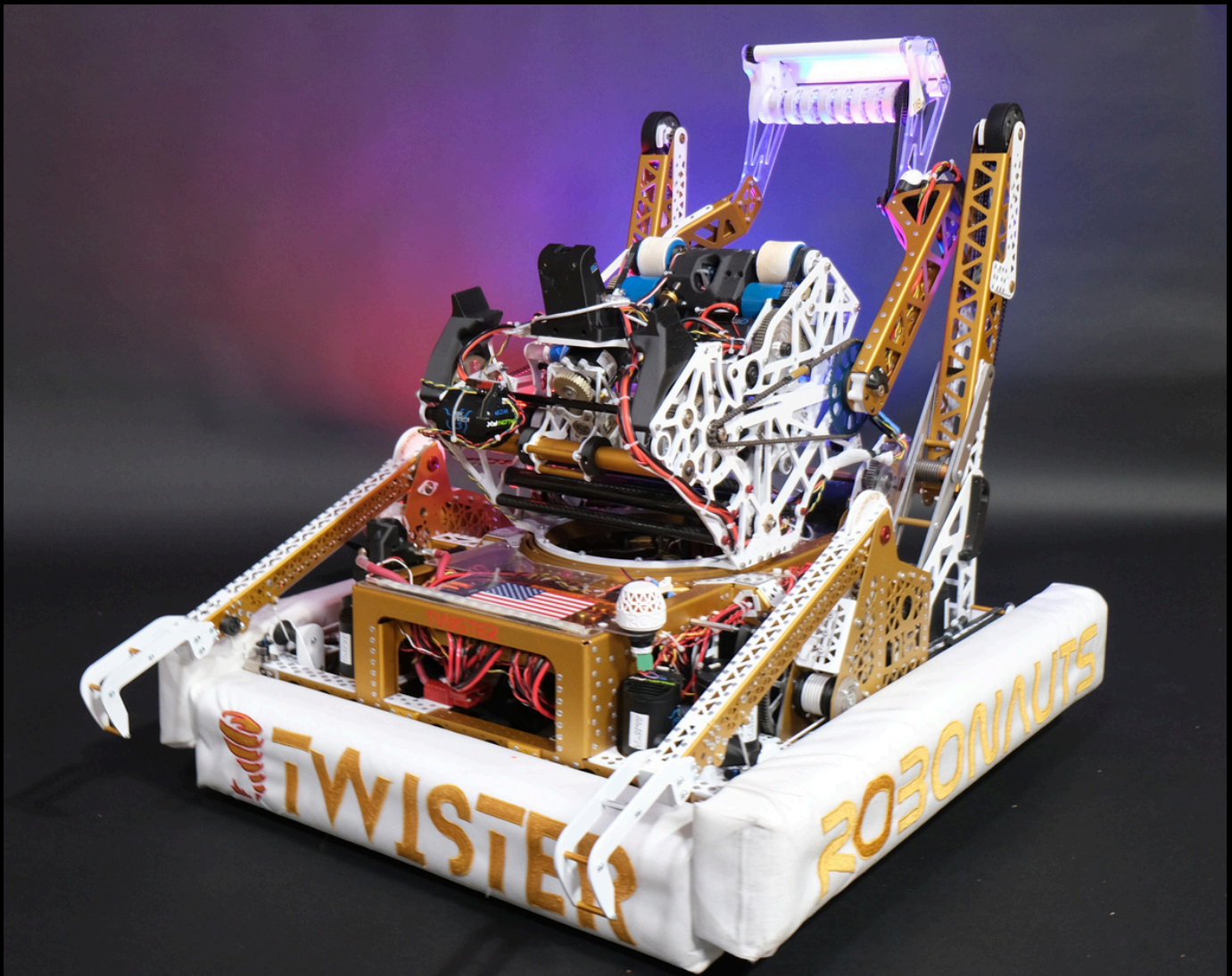


THE ROBONAUTS

2024 TECHNICAL BINDER



2024

TABLE OF CONTENTS



INTRODUCTION

<i>Overview</i>	1
<i>The Robonauts Goals</i>	1
<i>Season Statistics</i>	2

II. TWISTER

<i>Chassis</i>	4
<i>Energy Chain</i>	5
<i>Intake</i>	6
<i>Turret</i>	7
<i>Shooter</i>	8
<i>Shooter Pitch</i>	9
<i>Diverter</i>	10
<i>Climb</i>	11
<i>Avionics</i>	12
<i>Software</i>	13



OVERVIEW

The Robonauts were founded 28 years ago, based on a partnership between NASA's Johnson Space Center and Clear Creek Independent School District. During the 2024 season our team of 81 students and 19 mentors competed at 7 events during the official Crescendo 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

114 MATCHES
PLAYED

Most of any team
during the 2024
official season

136 UNIQUE
ALLIANCE
PARTNERS

8 BLUE
BANNERS



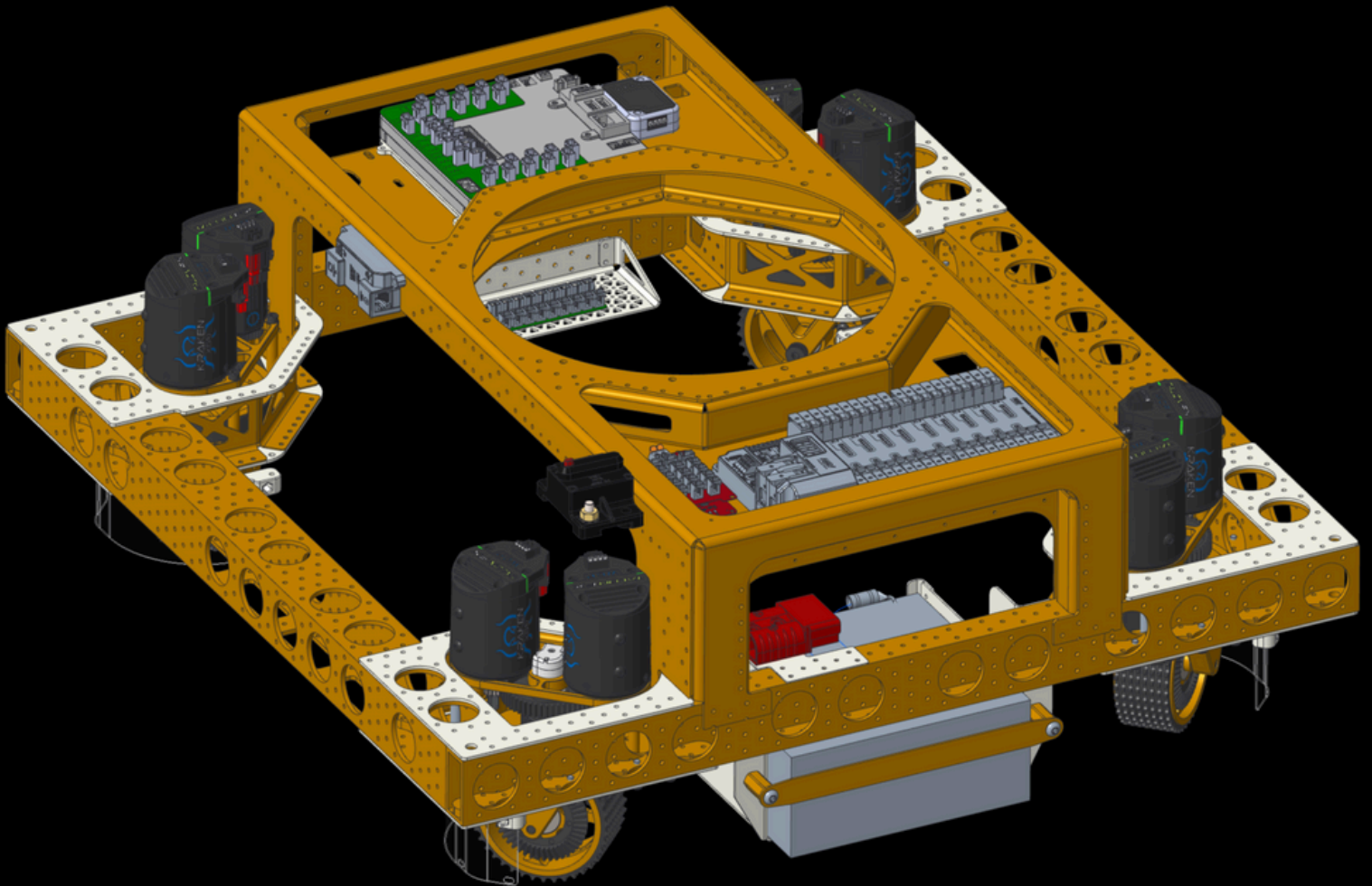
TWISTER



BUILT FOR THE 2024 FIRST ROBOTICS
COMPETITION GAME "CRESCENDO"

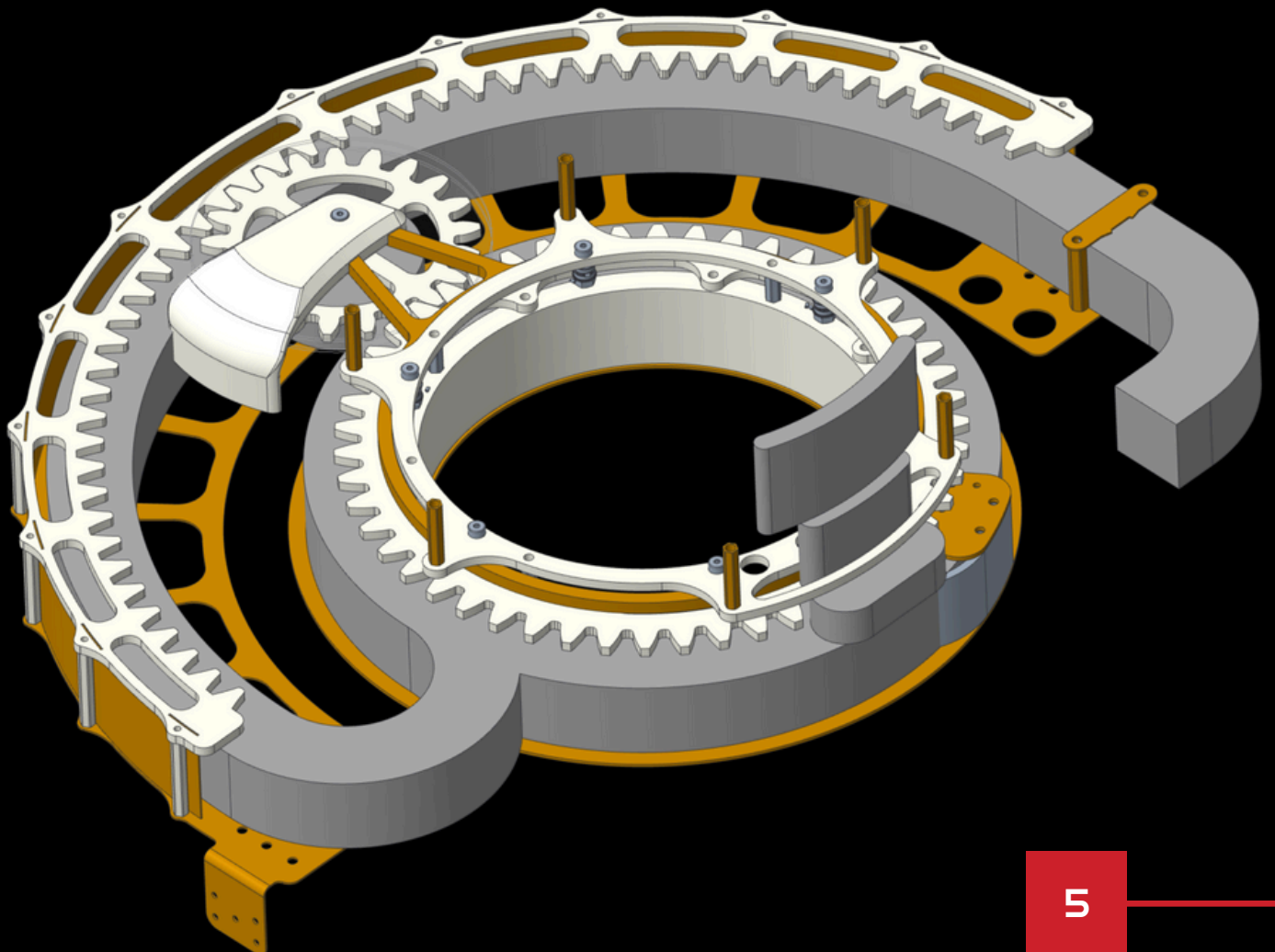
CHASSIS

- *27" X 27" Frame*
- *Frame made from 1" X 2" and 2" X 2" 1/8" wall aluminum box tubing*
- *Swerve Drive Specialties Mk4 modules with L2 ratio and GripLock tires*
- *Modules mounted from the bottom of the frame to increase intake clearance*
- *0.090" aluminum superstructure*
- *Integrated swerve module guards to aid in intaking notes*
- *PDH, roboRIO, Canivore, and custom low-voltage power distribution unit mounted in "pods" next to the turret*
- *Bottom of chassis is left open to house energy chain and intake subsystems*



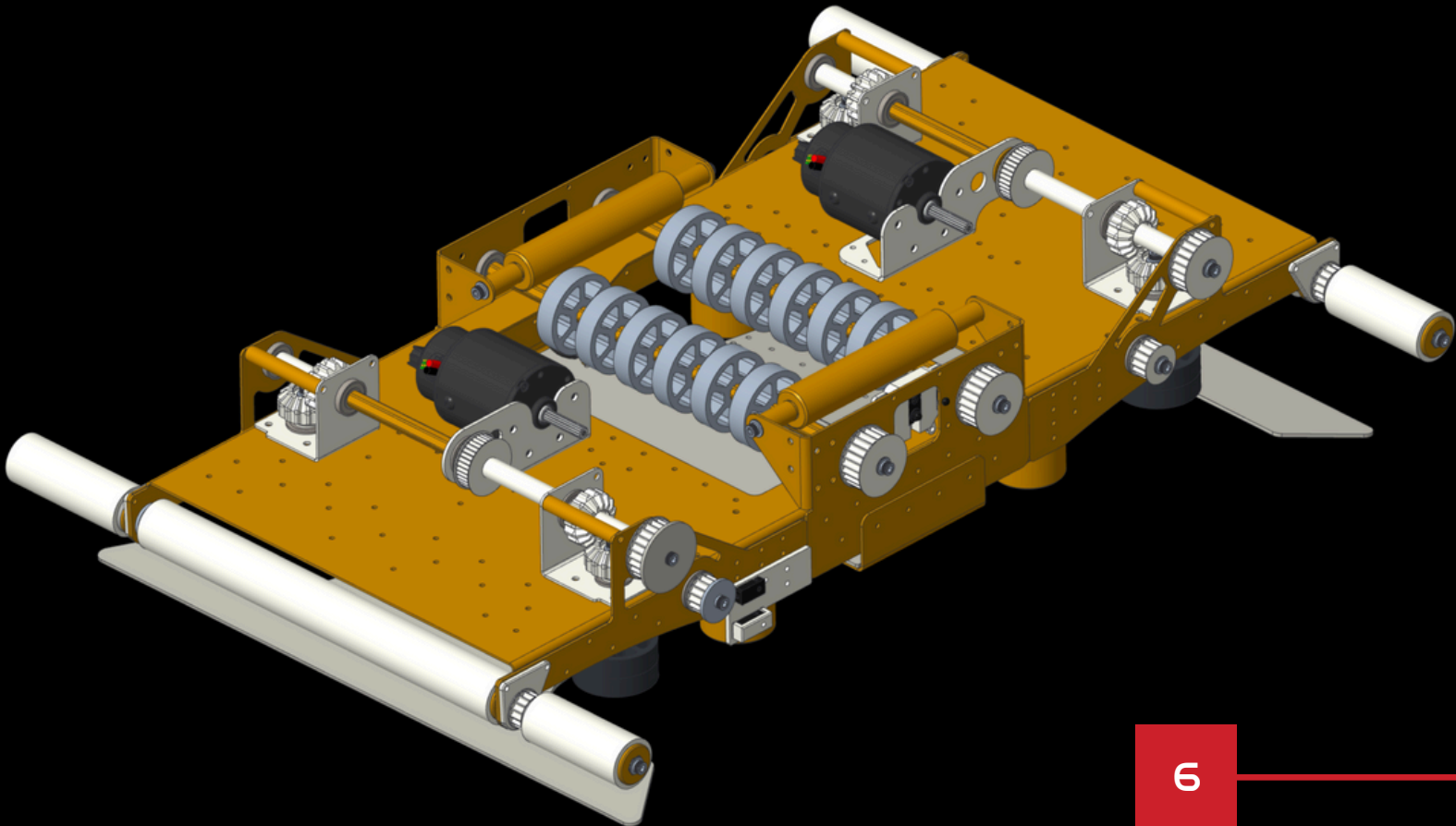
ENERGY CHAIN

- *WCP Bi-Directional energy chain contained within a twist capsule*
- *Custom planetary gearset with diametral pitch matched to the DP of the energy chain with 420 degrees of rotation*
- *Sun gear and planet carrier are driven by the turret, ring gear is stationary*
- *Energy chain is always driven within the twist capsule to prevent buckling that would occur if not driven*
- *Spring steel sheets are installed inside the energy chain to push chain towards outer wall of twist capsule*
- *Conductors for 6 motors + a spare set, can wires + a spare set, 2 ethernet cables for 2 Limelights + 2 spares, signal wires + spare for beam brake sensors all run through the energy chain*



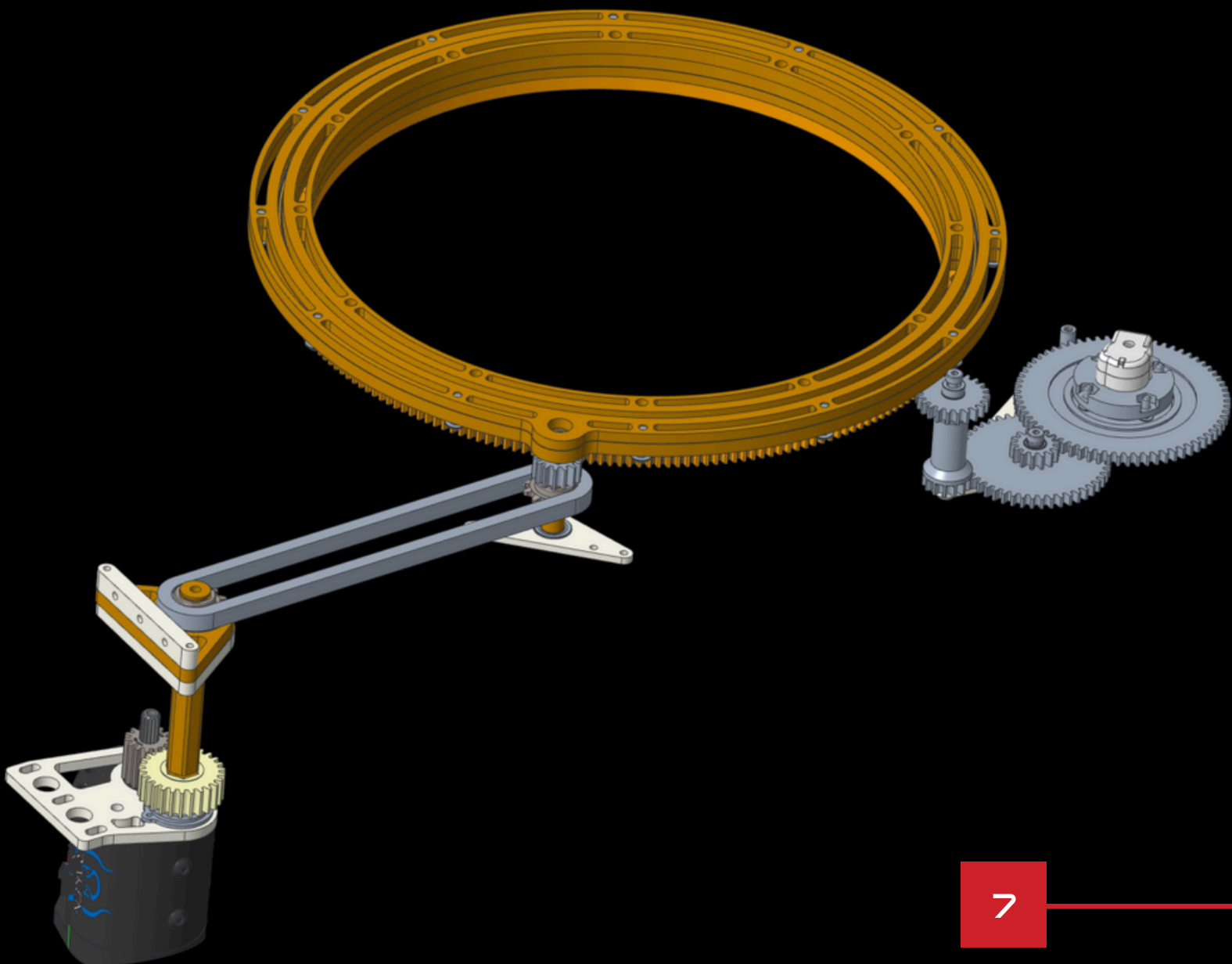
INTAKE

- *Dual-sided, roller-dust pan intake*
- *Each side independently powered by a Falcon 500 with a 2.25: 1 reduction*
- *Front roller is a 1.25" silicone roller that pulls the note up the dustpan where it is then compressed horizontally between 2" flex wheels driven through a miter box*
- *Counter rotating 2" flex wheel "elevator rollers" redirect the note vertically into the turret*
- *8 passive rollers are used to help guide note through the intake*
- *A CTRE Pigeon is mounted the the bottom of the dustpan in the center of the robot*
- *3 sets of beam break sensors are used to drive two note mode logic and to signal to drivers when a note is in the robot*
- *Entire intake is removable with 4 bolts and drops out of the bottom of the robot*



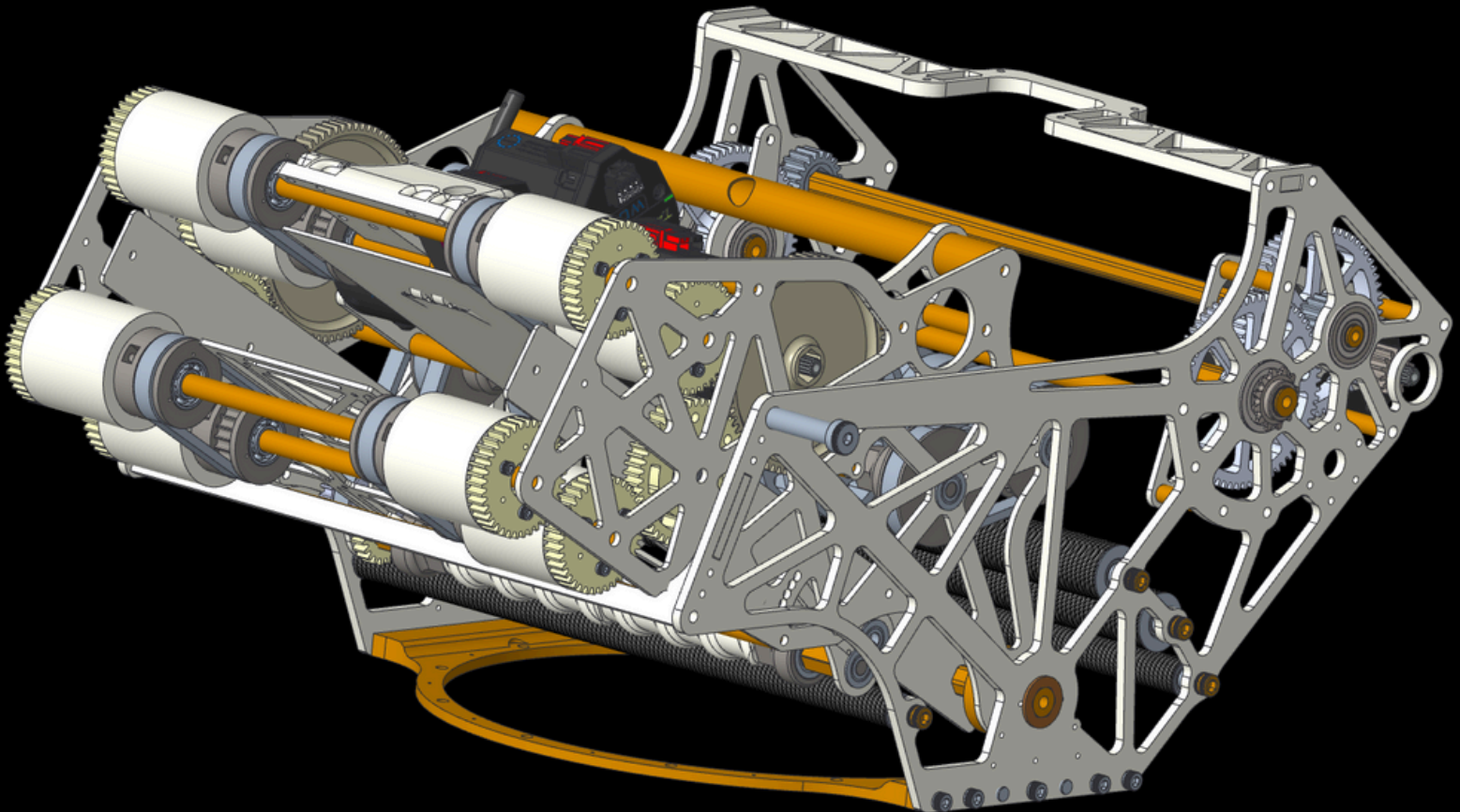
TURRET

- *11" 1/4" section Lily bearing clamped with plates (Until Champs)*
- *Bearing was replaced with a delrin ring for champs due to repeated bearing failures*
- *Driven by a Kraken X60 with an overall ratio of 30.5:1*
- *Motor mounted on chassis and connected to turret ring with a tensioned chain run*
- *Cancoder geared up to provide full APS coverage over 420 degree of travel of turret*



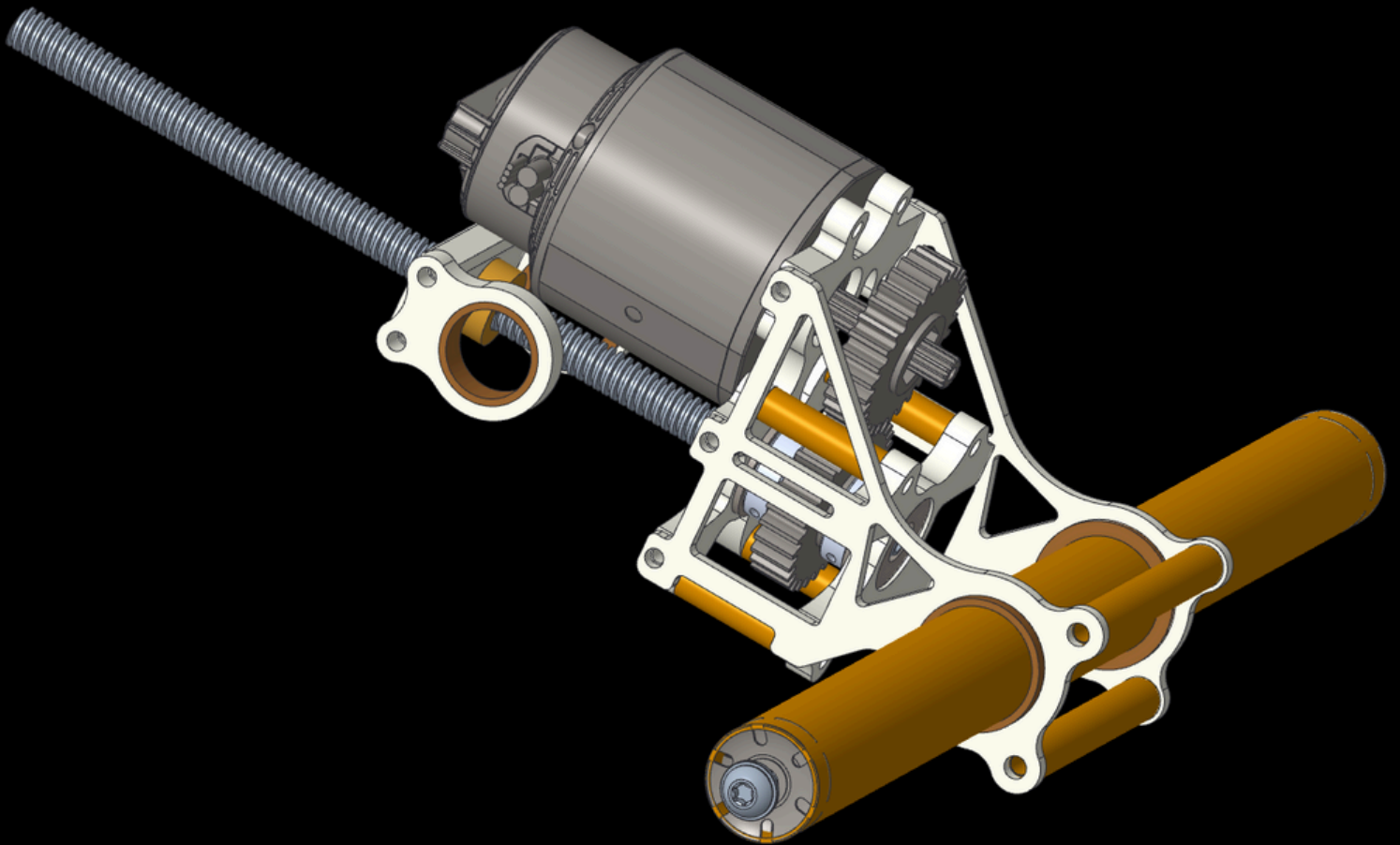
SHOOTER

- *Eight 2" Fairlane shooter wheels*
- *Left and right side are driven independently by Kraken X60's to control spin*
- *Servo actuated gate to prevent Note from leaving shooter prematurely*
- *Shooter feeder with half shafts riding on one way bearings to allow shooter wheels to launch note without back driving feeder gearbox*
- *Passive carbon fiber rollers work with active feeder rollers to reorient the Note when it passes through the turret*
- *Shooter wheels primarily driven with gears for increased efficiency*



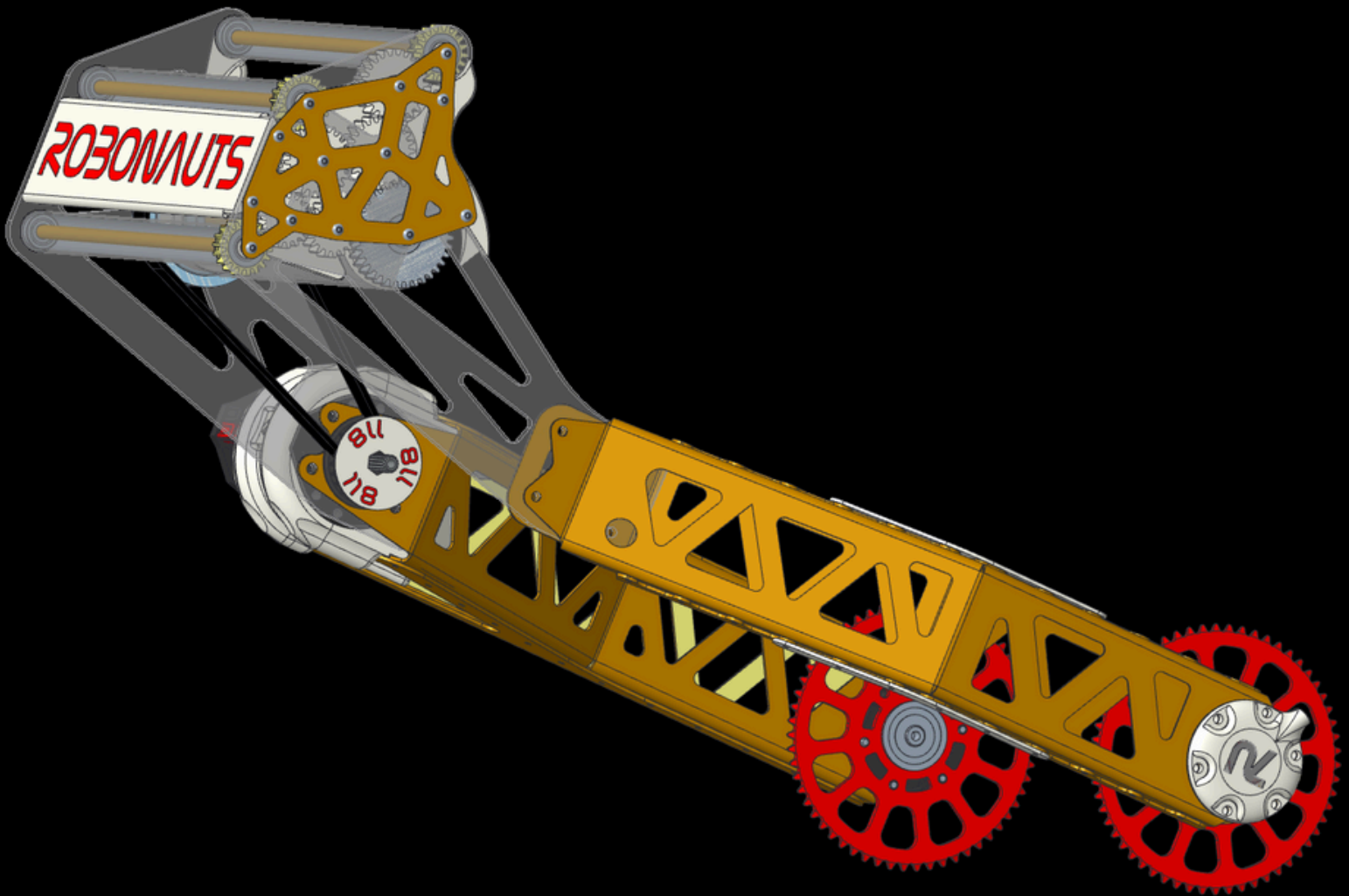
SHOOTER PITCH

- *Driven by 3/8"-12 leadscrew*
- *Driven by a Falcon 500 with a 1:1 ratio*
- *Leadscrew chosen for low backlash and for being non-backdrivable*



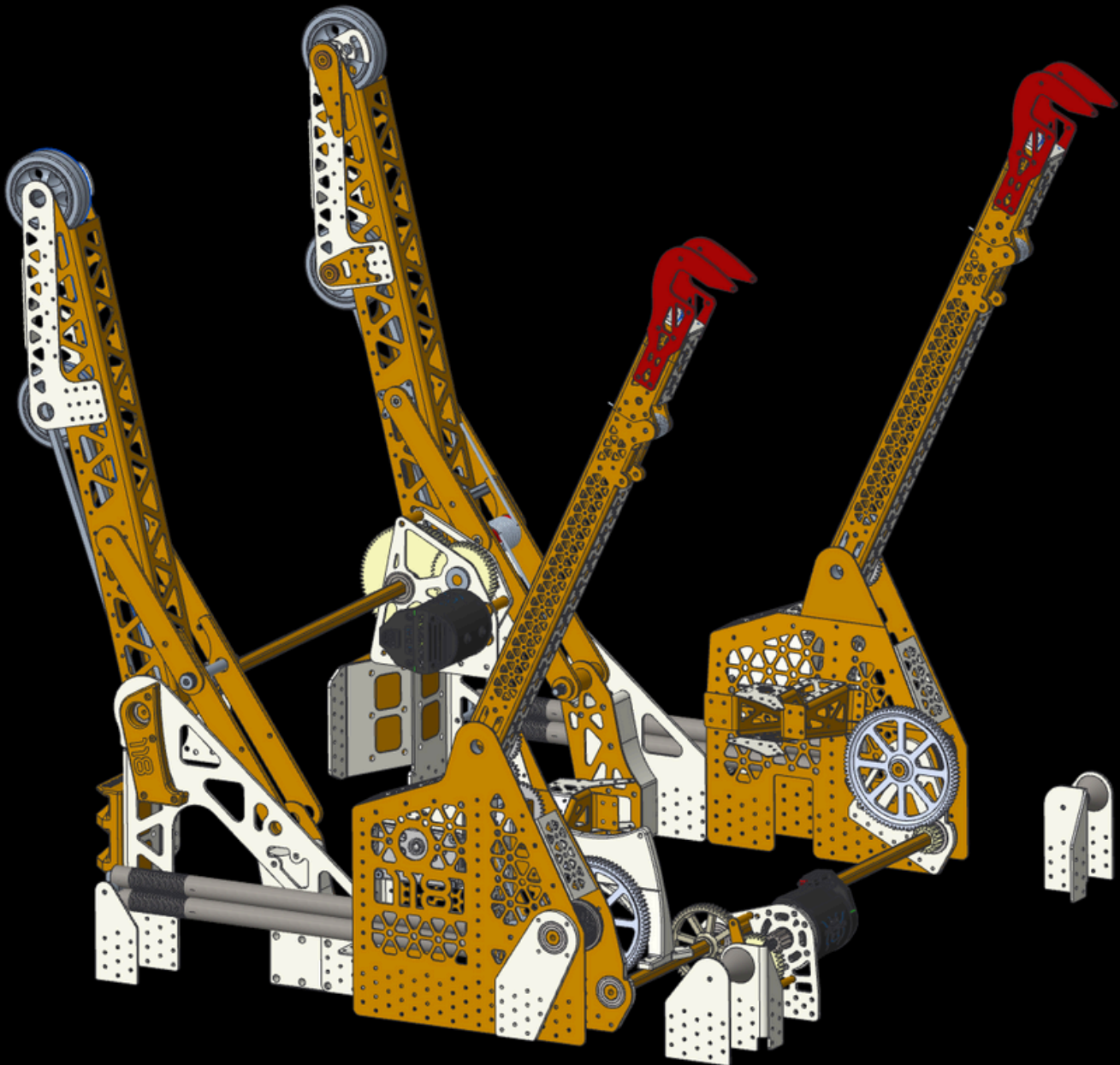
DIVERTER

- *Diverter deploy is driven with a Kraken X60 with a 70:1 ratio*
- *Diverter rollers are driven by Kraken X60 with 1.5:1 ratio to main roller and geared to smaller rollers*
- *Secondary rollers driven by 3D printed gears with 1/4" bearings pressed in*
- *Hybrid sheet metal and polycarbonate structure to allow diverter to flex when running into the Amp*



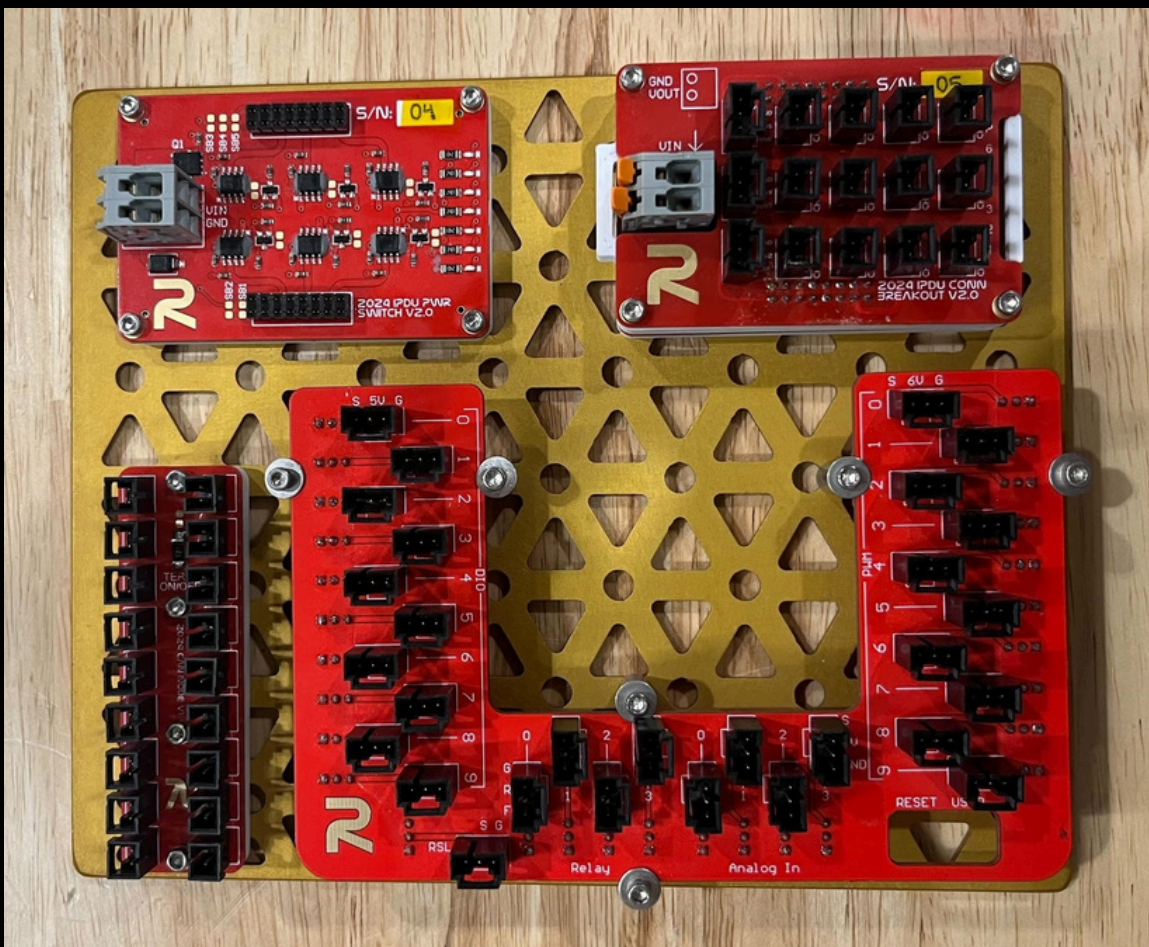
CLIMB

- *Kraken X60 driven “Chain Arms” that passively deploy when arms begin to un-winch lift robot on the chain*
- *Kraken X60 driven “Skis” that drive up the stage wall and passively deploy when ski wheels begin to rotate*
- *Cancoder on chain arms allows for fully autonomous endgame routine*



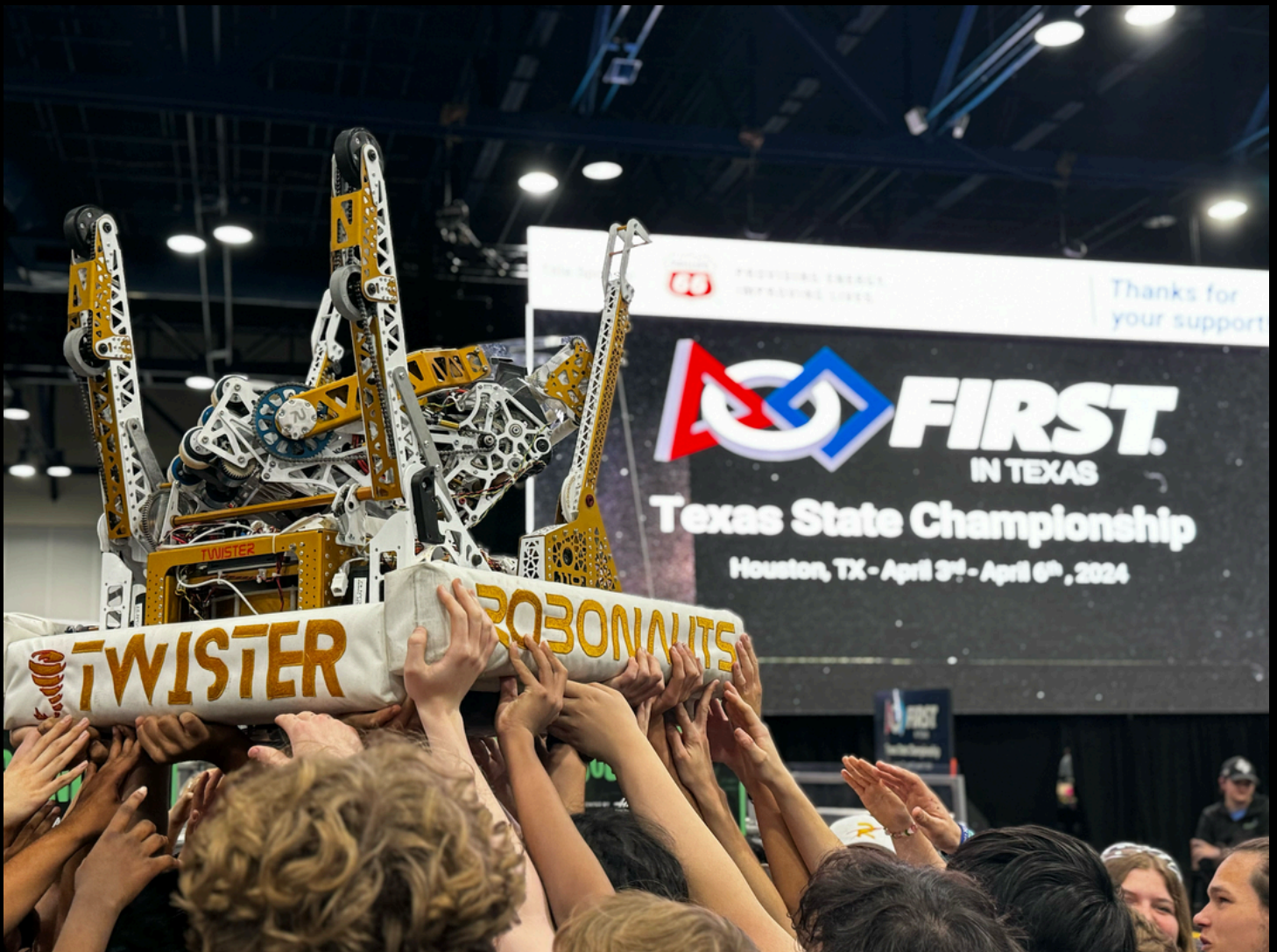
AVIONICS

- *18 Channel CAN Node*
 - *Custom CAN Bus Board to Implement Star Topology*
 - *One Channel Per Device/subsystem*
 - *Optional On-Board Termination*
- *Intelligent Power Distribution Unit*
 - *Power Distribution to Low-Current Devices (CANcoders, Limelight, Pigeon, etc.)*
 - *6 Switchable Channels using roboRIO DIO Ports*
 - *Short-Circuit Protection*
 - *Thermal Shutdown Protection*
 - *Slew Rate Control*
 - *ESD Protection*
 - *Reverse Voltage Protection*
 - *Status LED for each Channel*



SOFTWARE

- *Robot Programmed in C++*
- *Lua scripted autonomous and driver sequences*
- *Team developed swerve code and path planning*
- *Autonomous Note tracking using Limelight 3's and Google Corals determines robot path during autonomous period*
- *Localized ferry setpoints*
- *Logic for possessing two notes for less-than-momentary period during match that auto-ejects second note after 2 seconds*



THANKS TO OUR 2024 SPONSORS

