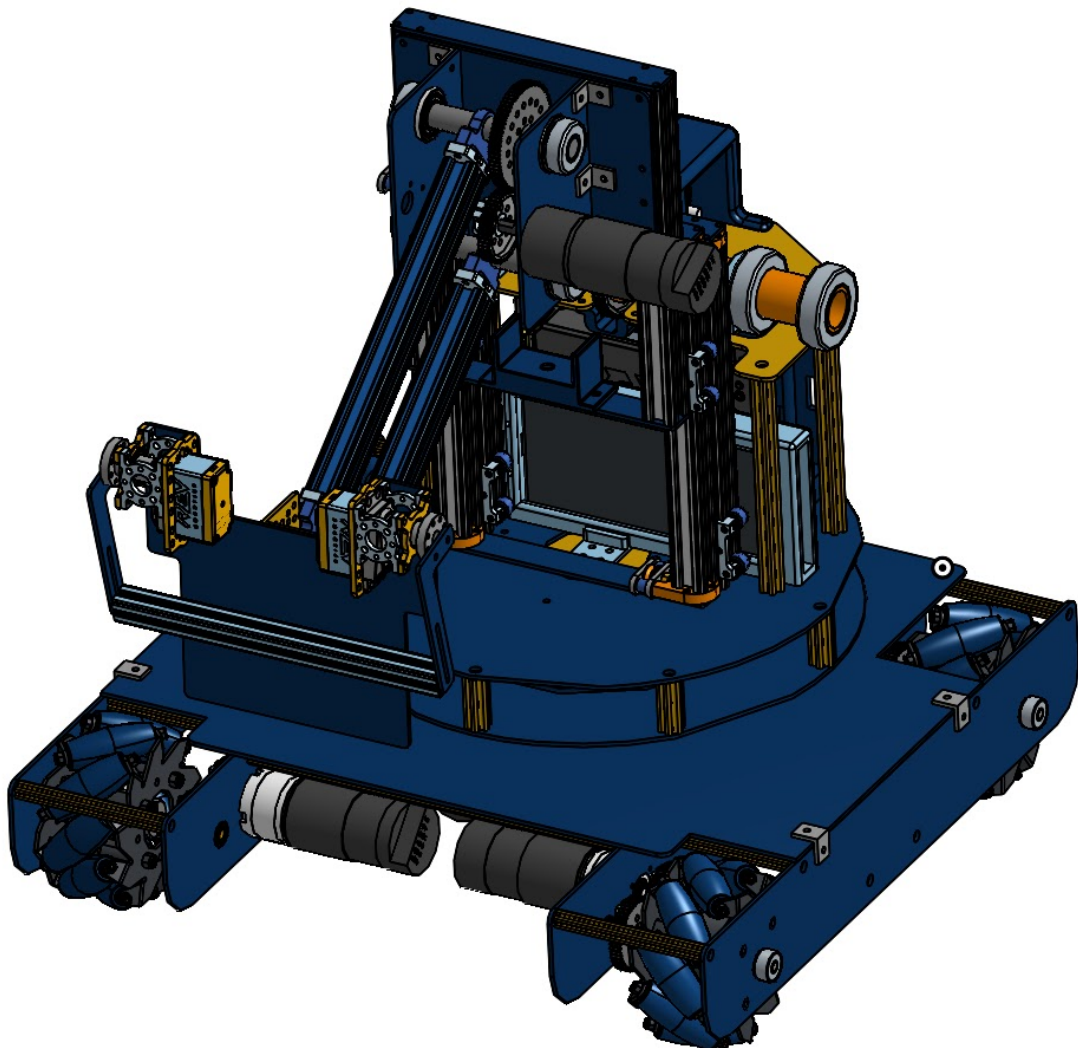
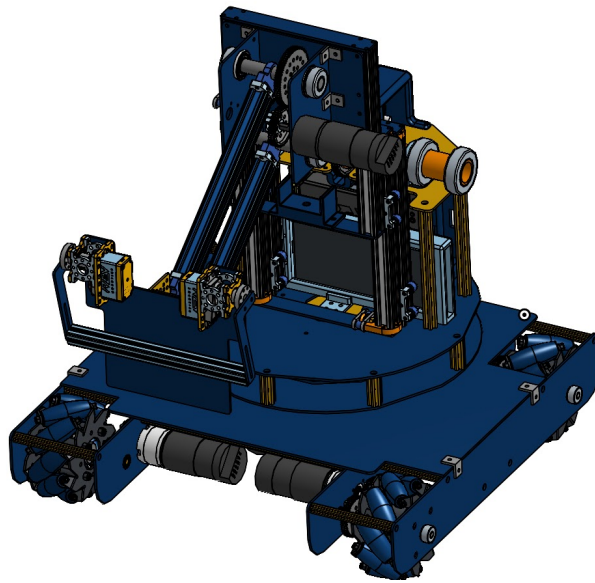


Revolutionary Robots Technical Binder



Armstrong



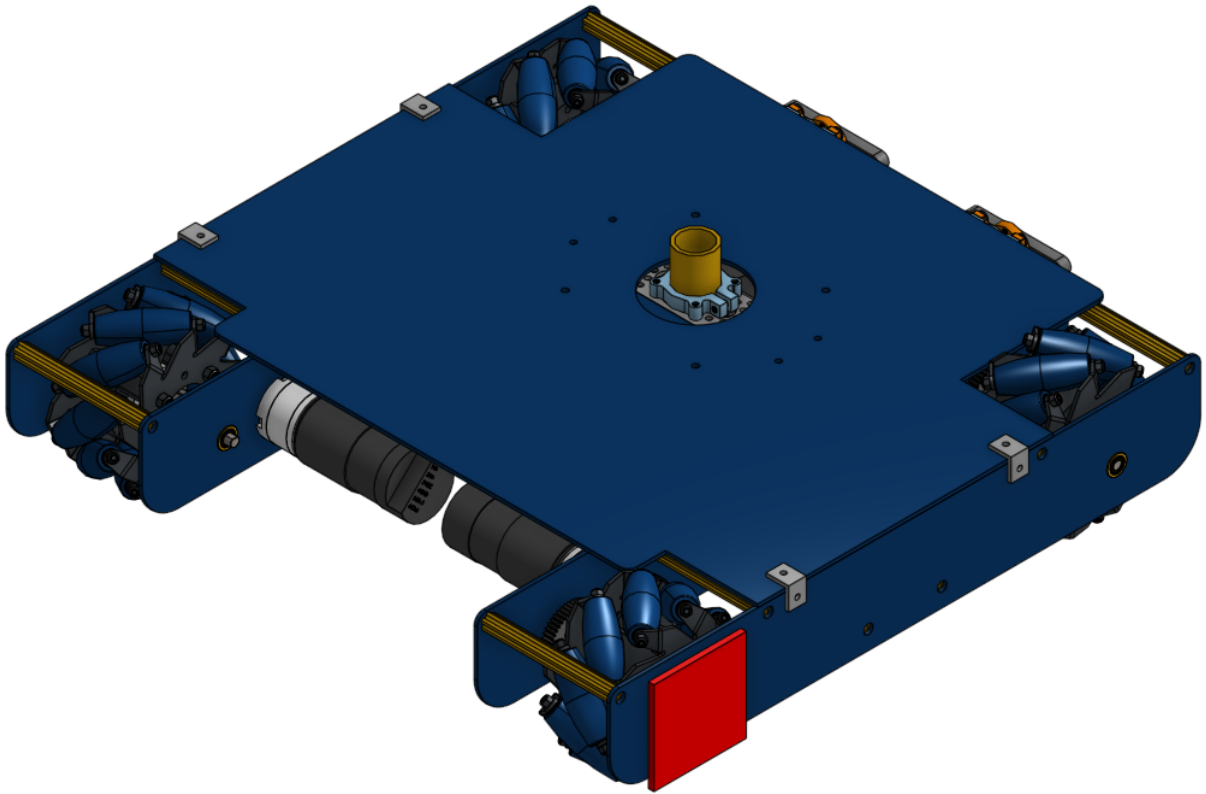
Details

- ★ Weight: 27.8 lbs.
- ★ Size at start of match: 18 inches x 16.5 inches x 17.75 inches
- ★ Size in neutral state: 20 inches x 16.5 inches x 14 inches

Abilities

- ★ 4-wheel mecanum drive allows movement in any direction without turning
- ★ Rotating turret which turns independently of the drivetrain
- ★ 3 stage lift allows stacking of Skyscrapers 7 levels high
- ★ Claw allows for quick intake and stacking without interfering with nearby stones

Wheelbase



Custom Drivetrain Structure

- ★ Sparkle Electric Blue powder-coated 5052 aluminum with a thickness of 0.090
- ★ Custom cut ½ inch gold churros

Mecanum Drive

- ★ Utilizes goBILDA mecanum wheels with rollers supported by ball-bearings so that they rotate smoothly
- ★ Can quickly and precisely move in any direction, allowing for accurate autonomous and mobility during teleOp period
- ★ 20:1 Orbital NeveRest Gearmotors to drive wheelbase and allow us to get to faster speeds
- ★ HighTec HS-485HB Servos grab the foundation plate for a controlled move

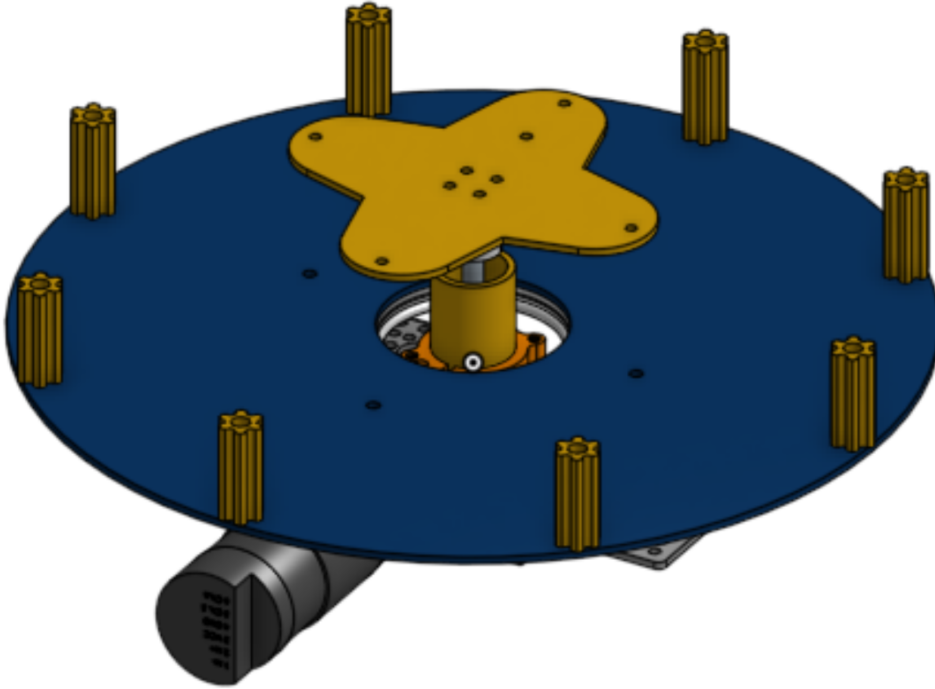
Movement of Foundation

- ★ HighTec HS-485HB Servos simply and easily allow for movement of foundation
- ★ ServoBlocks™ increase the servos' load-bearing capabilities by helping to isolate the lateral load from the servo spline and case

Bill of Materials for Wheelbase		
Item with Description	Source (Part No.)	Quantity
Top Plate: Custom cut aluminum sheet 5052 .090, Powdered coated Electric Blue	Purchased: Metal Supermarket Cut: Envision Rapid Cutting Powder coated: Topps Powder Coating	1
Outside Plate: Custom cut aluminum sheet 5052 .090, Powdered coated Electric Blue with gold vinyl team number	Purchased: Metal Supermarket Cut: Envision Rapid Cutting Powder coated: Topps Powder Coating	2
Inside Plate: Custom cut aluminum sheet 5052 .090, Powdered coated Electric Blue	Purchased: Metal Supermarket Cut: Envision Rapid Cutting Powder coated: Topps Powder Coating	2
½ in. Churro, gold: custom cut to 9 inches	Andymark (am-3101-3_GOLD)	2
½ in. Churro, gold: custom cut to 3.5 inch	Andymark (am-3101-3_GOLD)	12
3/8" x 3/8" 90° X-Rail Bracket	Servocity (585070)	4
NeveRest Orbital 20 Gearmotor	Andymark (am-3637)	4
3036 Series Mecanum Wheel Set - 100 mm diameter, rollers replaced with custom dyed rollers	GoBilda Wheels: (3213-3606-0001) Rollers: (3611-0001-0002)	1
1206 Series Pattern Adapter	Servocity (1206-0016-0002)	4
¼in. D-Bore Barrel Hub	Servocity (545692)	4
6mm D-Shaft 100mm	Andymark(am-3226-100)	4
6mm ID x 12 mm Flanged Ball Bearings	Servocity (535220)	4
1/2" Bore 32 Pitch 48 Tooth Aluminum Hub Gears	Servocity (615190)	8
Clamping D-Hubs (Tapped), 0.770" Pattern	Servocity (545618)	8

Aluminum Clamp Collar 6mm ID, 16mm OD	Servocity (2910-0816-0006)	4
Standard Hub Shaft ServoBlock™ (24T Spline)	Servocity (637110)	2
HS-485HB Servo	Servocity (33485S)	2
2.31" (7 hole) Aluminum Beams	Servocity (585406)	2

Turret



Rotation Independent of Drivetrain

- ★ 9" Ball Bearing Turntable allows for stability and ease of rotation
- ★ Wire management allows rotation of 180° in each direction from neutral for 360° total rotation

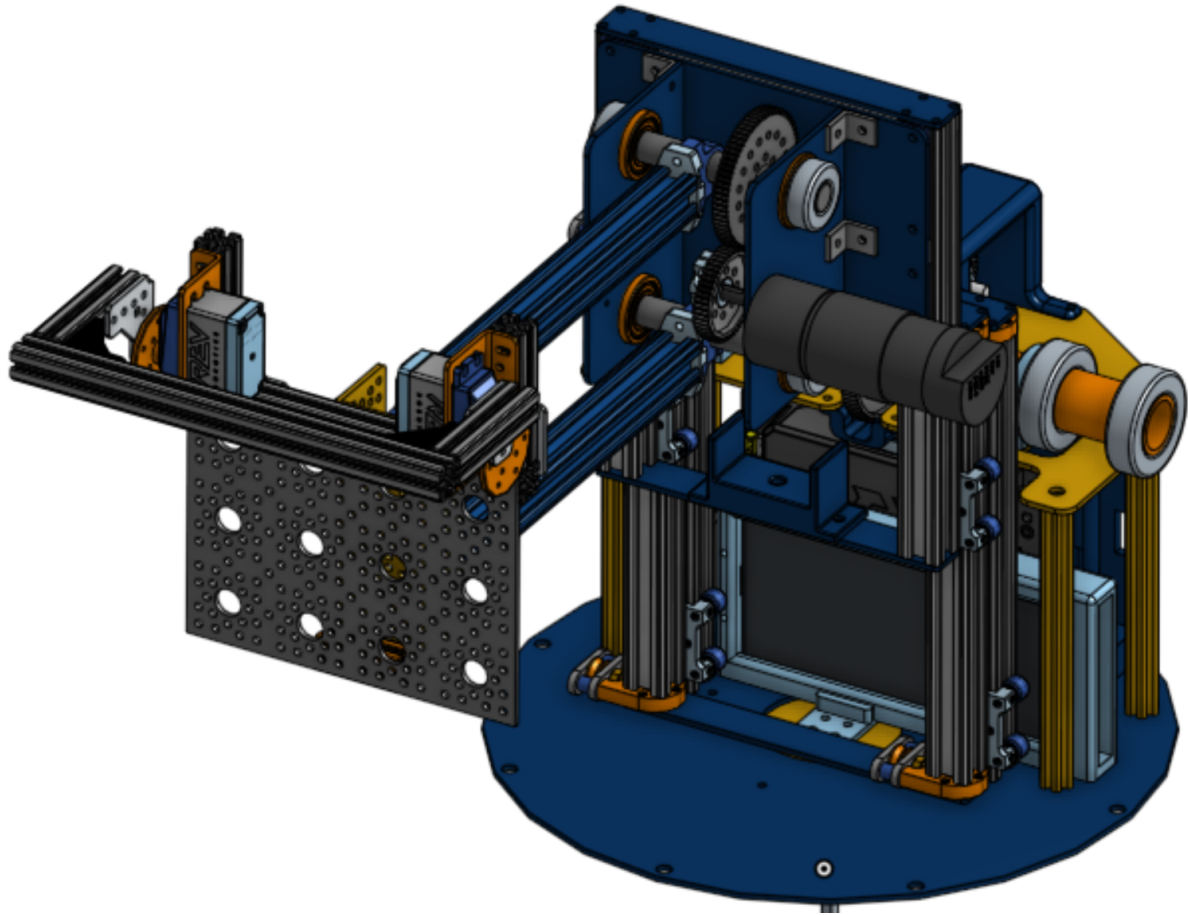
Powered by NeverRest 60:1 Gear Motor

- ★ NeverRest 60:1 Motor combined with bevel gears in a 1:2 ratio allows for a rotation of 190.8 degrees per second

Bill of Materials for Turret		
Item with Description	Source (Part No.)	Quantity
Bottom Plate: Custom cut aluminum sheet 5052 .090, Powdered coated Electric Blue	Purchased: Metal Supermarket Cut: Envision Rapid Cutting Powder coated: Topps Powder Coating	1
½ in. Churro, gold: custom cut to 1.25 inches	Andymark (am-3101-3_GOLD)	8
9" Ball Bearing Turntable	Servocity (6031K21)	1
"Starfish" Top Support Plate: Custom cut aluminum sheet 5052 .090, Powdered coated Gold Nugget	Purchased: Metal Supermarket Cut: Envision Rapid Cutting Powder coated: Topps Powder Coating	1
¼" Stainless Steel D-Shafted, 4 inch length	Servocity (634080)	1
0.575" Pattern Clamping Hub	Servocity (unknown part number)	1
1.00" x 2.00" Aluminum Tubing	Servocity (635102)	1
4.50" Aluminum Channel	Servocity (585444)	1
0.25"Length, 1/4" OD Aluminum Spacers for #6 Screw Size (0.140" ID)	Servocity (633164)	4
26 Tooth, 1/4" Bore, 20 Pitch, Hub Mount Bevel Gear	Servocity (615460)	1
13 Tooth, 6mm D-Bore, 20 Pitch, Shaft Mount Bevel Gear	Servocity (615458)	1
1/4" D-Bore Clamping Hub for Hub Mount Bevel Gear	Servocity (545309)	1
Clamping D-Hub (Tapped), 0.770" Pattern, 0.25" Bore	Servocity (545619)	1
1/4" ID x 1/2" OD Flanged Ball Bearing	Servocity (535198)	2
90° Dual Side Mount E	Servocity (585596)	2

3" x 1.5" Pattern Plate (3 hole)	Servocity (585720)	1
NeverRest 60:1 Gearmotor	Andymark (am-3103)	1
Spur Gear Motor Mount G	Servocity (555196)	1

Lift



3 Stage X-Rail Lift

- ★ Can move at 4.5 in per second
- ★ Allows stacking Skyscrapers 7 levels high

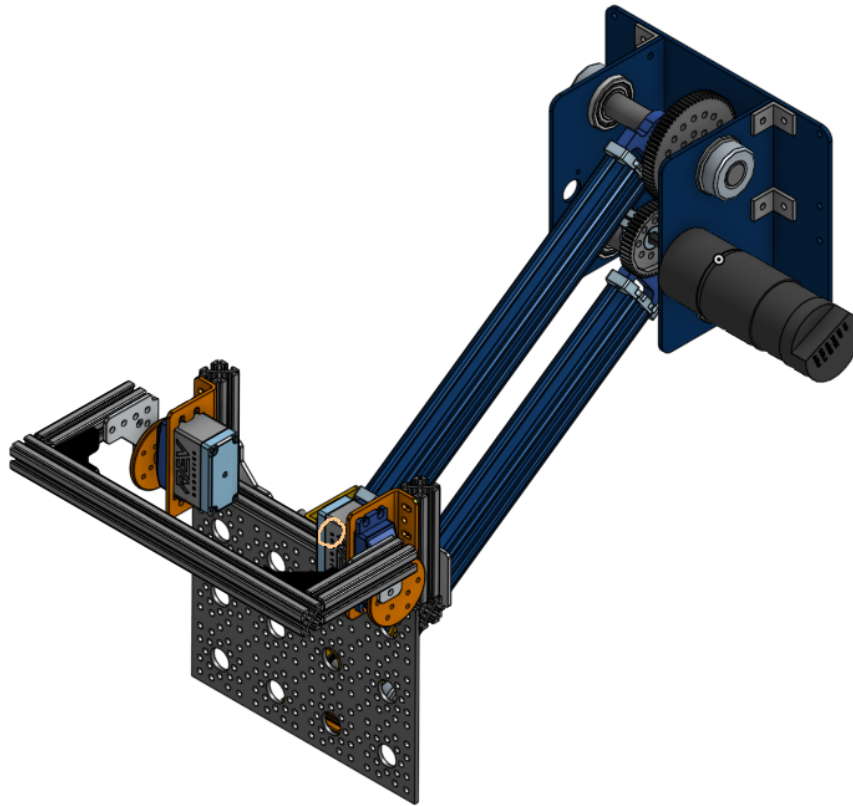
Powered by a NeveRest 20 Motor

- ★ NeveRest 20 motor powers 24 tooth gear that leads to a 48 tooth gear on pulley that results in a 1:2 ratio

Bill of Materials for Lift		
Item with Description	Source (Part No.)	Quantity
Bottom Plate: Custom cut aluminum sheet 5052 .090, Powdered coated Electric Blue	Purchased: Metal Supermarket Cut: Envision Rapid Cutting Powder coated: Topps Powder Coating	1
½ in. Churro, gold: custom cut to 5.25 inches	Andymark (am-3101-3_GOLD)	4
Pulley Plate: Custom cut aluminum sheet 5052 .090, Powdered coated Gold Nugget	Purchased: Metal Supermarket Cut: Envision Rapid Cutting Powder coated: Topps Powder Coating	1
NeveRest Orbital 20 Gearmotor	Andymark (am-3637)	1
37mm Bore Bottom Tapped Clamping Mount	Servocity (555116)	1
1" Bore Bottom Tapped Pillow Block	Servocity (535170)	2
1.00" x 10.00" Aluminum Tubing	Servocity (635118)	1
1.00" ID Aluminum Clamp Collar	Servocity (6157K18)	4
32 Pitch, 76 Tooth (1.00" Bore) Aluminum Hub Gear	Servocity (615222)	1
1" Bore, Face Tapped Clamping Hub, 1.50" Pattern	Servocity (545352)	1
32 Pitch, 48 Tooth (0.50" Bore) Aluminum Hub Gear	Servocity (615190)	1
Clamping D-Hub (Tapped), 0.770" Pattern, 0.25" Bore	Servocity (545619)	1
3D Printed Gear Guard	Custom (See CAD 4.7)	1
Xrails, custom cut to 8 inches	Servocity (565062)	6

Custom x-rail connection plates, Custom cut aluminum sheet 5052 .090, Powdered coated Electric Blue	Purchased: Metal Supermarket Cut: Envision Rapid Cutting Powder coated: Topps Powder Coating	5
Custom x-rail connection plates with camera mount, Custom cut aluminum sheet 5052 .090, Powdered coated Electric Blue	Purchased: Metal Supermarket Cut: Envision Rapid Cutting Powder coated: Topps Powder Coating	1
1.5mm Deep Metal V Groove Guide Pulley Rail Ball Bearings Wheel	Amazon	8
3D Printed Bearing Holders	Custom (See CAD 4.7)	16
.25 length, 1/4" OD Aluminum Spacers for #6 Screw Size (0.140" ID)	Servocity (633164)	16
Side Tapped Pattern Mount C	Servocity (545360)	4
Locking washers	Servocity (91102A007)	16
Mini V-Wheels	Servocity (615454)	16
100% UHMWPE Braided Cord, 350 lb tensile strength	Amazon	18 ft

Arm



Double Bar Arm

- ★ Double bar design keeps claw is parallel to the ground at all times
- ★ Length of arm allows extension over stones at front of foundation

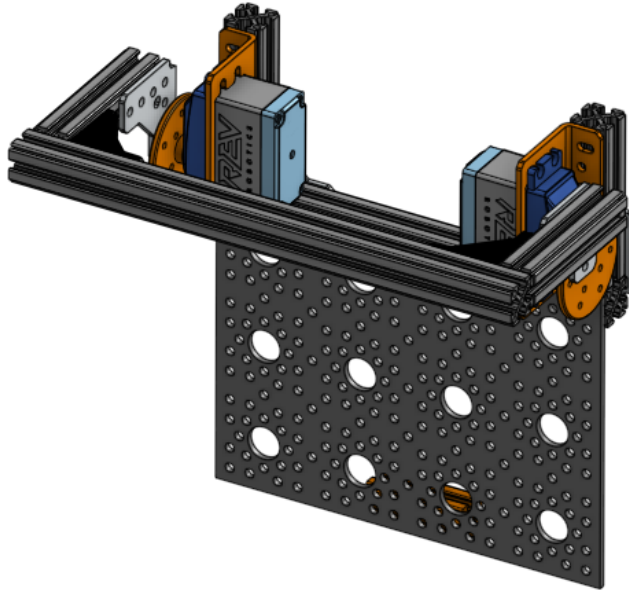
Powered by NeverRest 60 motor

- ★ Motor provides power and precision for fine movements
- ★ Gear ratio of 1:2 to increase torque and slow movement

Bill of Materials for Arm		
Item with Description	Source (Part No.)	Quantity
Back Plate: Custom cut aluminum sheet 5052 .090, powdered coated Electric Blue	Purchased: Metal Supermarket Cut: Envision Rapid Cutting Powder coated: Topps Powder Coating	1
Side Plate: Custom cut aluminum sheet 5052 .090, Powdered coated Electric Blue	Purchased: Metal Supermarket Cut: Envision Rapid Cutting Powder coated: Topps Powder Coating	2
3/8" x 3/8" 90° X-Rail Bracket	Servocity (585070)	6
NeverRest 60:1 Gearmotor	Andymark (am-3103)	1
1/2" Stainless Steel Precision Shafting	Servocity (634230)	2
1/2" ID x 1 1/8" OD Flanged Ball Bearing	Servocity (535049)	4
0.50" ID Aluminum Clamp Collar	Servocity (6157K14)	4
1/2" Bore, 72 Tooth, 32 Pitch Aluminum Hub Gears	Servocity (615198)	1
Dual Pinch Bolt, Face Tapped Clamping Hubs, 0.770" Pattern, 1/2" inch bore	Servocity (545340)	1
1/2" Bore, 48 Tooth, 32 Pitch Aluminum Hub Gears	Servocity (615190)	1
Clamping D-Hub (Tapped), 0.770" Pattern, 0.25" Bore	Servocity (545619)	1
1/2" Bore Bottom Tapped Clamping Mount	Servocity (585546)	2
Flush Perpendicular X-Rail Mount	Servocity (585073)	4

Xrails, custom cut to 7 inches and powder coated Electric Blue	Servocity (565062) Powder coated: Topps Powder Coating	2
1/4" Bore Bottom Tapped Clamping Mount	Servocity (585542)	2
1/4" Stainless Steel Precision Shafting	Servocity (634162)	2
1/4" ID x 1/2" OD Flanged Ball Bearing	Servocity (535198)	4
1/4" ID Aluminum Clamp Collars	Servocity (625296)	4
4.50" Aluminum Channel, powder coated Gold Nugget	Servocity (585444) Powder coated: Topps Powder Coating	1

Claw



Double Servo Bar

- ★ The two servos on one bar allow for more pressure to grab the stone
- ★ The REV Smart Servo is a faster servo, to speed up the grabbing process
- ★ Servos in continuous rotation mode to act like motors and allow fine adjustments

Bill of Materials for Claw		
Item with Description	Source (Part No.)	Quantity
1" Extrusion, custom cut to 6"	REV Robotics (REV-41-1017)	1
4.5" x 6" Aluminum Pattern Plate	Servocity (585002)	1
1" Extrusion, custom cut to 1.5"	REV Robotics (REV-41-1017)	1
1" Extrusion, custom cut to 2.5"	REV Robotics (REV-41-1017)	4
15mm Metal 90 Degree Bracket V2	REV Robotics (REV-41-1480)	4
15mm Metal Bent Servo Bracket V2	REV Robotics (REV-41-1485)	2
Smart Robot Servo	REV Robotics (REV-41-1097)	2
Aluminum Servo Horn	REV Robotics (REV-41-1363)	2
15mm Plastic Inside Corner Bracket	REV Robotics (REV-41-1320)	2
1" Extrusion, custom cut to 7.84"	REV Robotics (REV-41-1017)	1
SoftTouch Self-Stick Non-Slip Surface Grip Pad - 4" x 5" Sheet - Black	Amazon	1
Logitech HD Pro Webcam C922	Best Buy	1
3D Printed Camera Mount	Custom (See CAD 4.9)	1

Programming

★ **Autonomous:**

Primary objective of autonomous planning is to maximize the autonomous scoring by creating a program that is easily adaptable to best work with alliance partners. This is done using custom classes and methods to easily replicate consistent movements and travel distance with encoders and quickly change programs to be adaptable with alliance partners. Multiple programs also increase the ability to adapt.

State machines are used to be more efficient with our time. perform multiple actions simultaneously to maximize scoring during the short autonomous period

★ **Primary two autonomous programs:**

Full Single Skystone Auto

1. Detect Skystone
2. Deliver to Skystone to Foundation
3. Move Foundation into Building Site
4. Park Under Skybridge

Double Skystone Auto

1. Detect Skystone
2. Deliver Skystone
3. Detect second Skystone
4. Deliver second Skystone
5. Park Under Skybridge

★ **Sensors used:**

1. Encoders are used for measuring movement of the wheels, turret, and arm.
2. Webcam used with Tensorflow to detect Skystone.

★ **Driver controlled enhancements:**

We adjusted the TeleOp code to allow us to move forward, strafe, or turn in any combination to allow efficiency of movement. Added a speed controller to allow for half speed for tasks requiring more accuracy and full speed for tasks where speed is the priority.

Presets were created to move an automatic 90 degrees on the turret, while letting the wheelbase move. Presets are able to be canceled by moving the turret.

Driver 1

2

1



B

A

B

A

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS XX.X - 1.0 ANGLES - 0.5° XXXX.X - 1.000 FINISHES - #		NAME DEW B.S.C.H.	DATE 06/20/2020
SURFACE FINISH ✓		CATEGORY AFFORDABLE	TITLE
DO NOT SCALE DRAWING DEW ALL SHARP EDGES AND REMOVE BURRS		MATERIAL ABS	PART NUMBER A
THIRD ANGLE PROJECTION 		SCALE 1:1	SHEET NUMBER 1 of 2

2

1

1

Driver 2

2



1

2

REV. NO.	DATE	BY	CHKD BY	FIG. NO.
				2 of 2