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POWER PLAY

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2022-2023 *FIRST*® Tech Challenge

Basic ‘Bot Guide for REV- Part 1

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Revision History		
Revision	**Date**	**Description**
1	8/8/2022	Initial Edits

Contents

Introduction

What is FIRST® Tech Challenge?

FIRST® Tech Challenge is a student-centered program that focuses on giving students a unique and stimulating experience. Each year, teams engage in a new game where they design, build, test, and program autonomous and driver operated robots that must perform a series of tasks. Participants and alumni of *FIRST* programs gain access to education and career discovery opportunities, connections to exclusive scholarships and employers, and a place in the *FIRST* community for life. To learn more about *FIRST*® Tech Challenge and other *FIRST*® Programs, visit www.firstinspires.org.

Gracious Professionalism®

FIRST® uses this term to describe our programs' intent.

Gracious Professionalism® is a way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community.

Watch Dr. Woodie Flowers explain *Gracious Professionalism* in this short video.

Introduction to this Guide

About this Guide

The Basic 'Bot Guide was created as a resource for teams looking for a step-by-step instructional guide to learn how to build a basic chassis and structure. There are multiple versions of this guide, previously called the "Push Bot Guide", this version the **Basic 'Bot Guide for REV Part 1** has been created to use the new and differing parts in the 2020-2021 season's REV kit of parts.

Parts

- REV FTC Competition Set
  - Tools included with this kit
- Electronics Modules and Sensors Set
- Control & Communication Set 1 or 2
- (Optional) A ruler is not needed to build this robot, but it is necessary to make sure that the robot is competition ready.

Tips and Tricks

- Secure the screws/nuts just enough, so parts do not slide/move relative to each other. Overtightening the screws will damage the aluminum extrusions.
- Make sure that set screws are installed in every axle hub, motor hub, and axle collar.
- Refer to the legend provided in the Kit of Parts, if any parts are unfamiliar.
- Make sure that all assemblies are square. It is hard to drive a crooked robot straight!
- The drive wheels are powered by two DC motors, which are relatively heavy. The drive wheels are on the back of the robot, because that is where the most weight is. This weight is needed to help the wheels grip the surface better.
- Omni wheels are on the front of the robot, which allows the robot to turn more easily. The omni wheels can slide sideways with very little friction due to the rollers.
- Unless otherwise noted, the top image in each step shows the necessary parts; the lower image shows the completed assembly.

Drive Assemblies and Frame

Step 1: Build Drive Brackets

Parts Needed

REV-41-1303 – Bracket, Motion (4)
REV-41-1361 – Nut, Locking, M3 (8)
REV-41-1359 – Screw, Hex Cap, M3, 8mm (8)

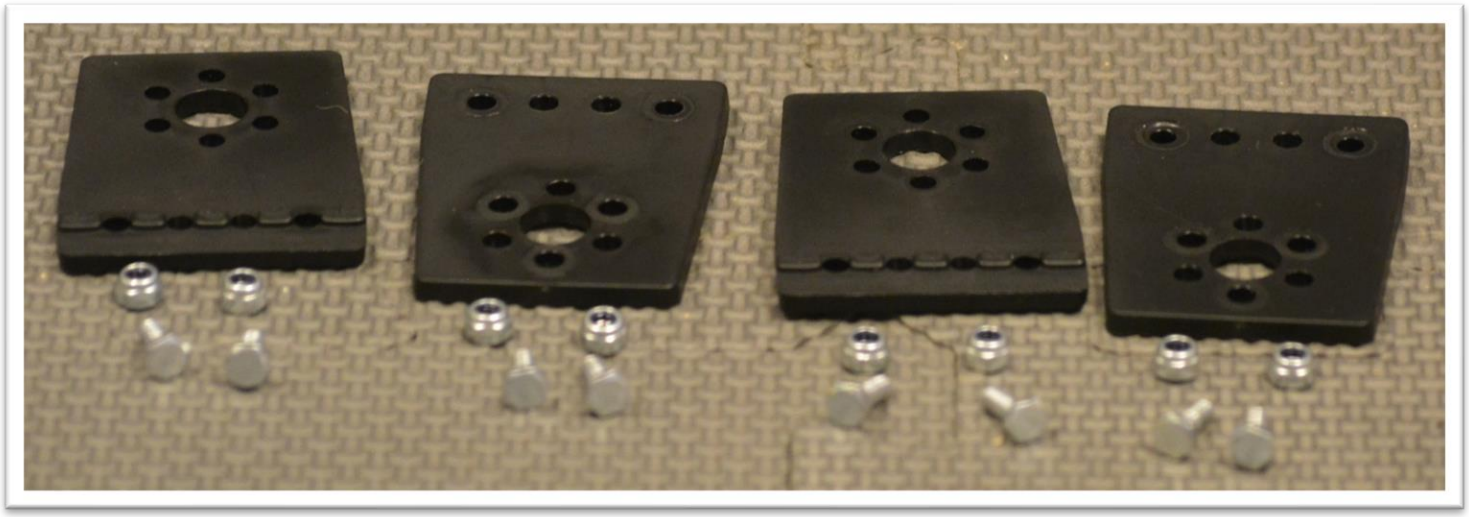

Figure 1- Unassembled view

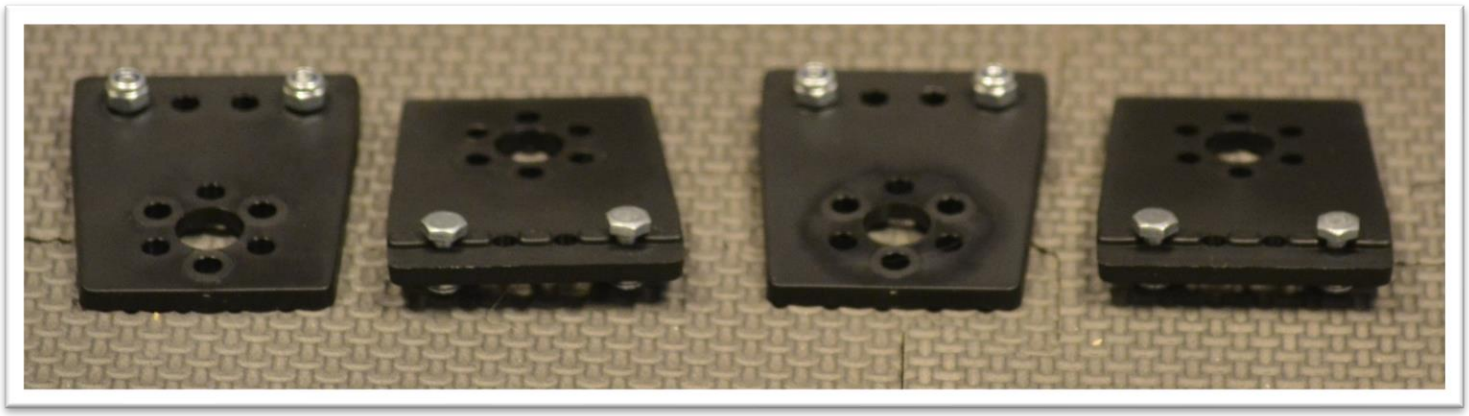

Figure 2- Assembled view

Helpful Hints

- Screw the nuts onto the screws just until it's difficult to turn them; just so that the nuts don't fall off. The screw heads will need to slide along the center of an extrusion in a later step.

Step 2: Build Motor Assemblies

Parts Needed:
REV-41-1300 – Core Hex Motor w/cables
(2; do not plug cables into the motors yet)
Drive Bracket Assemblies
(1 per motor, 2 total – use only two of the assemblies from step 1)
REV-41-1359 – Screw, Hex Cap, M3, 8mm
(3 per motor, 6 total)

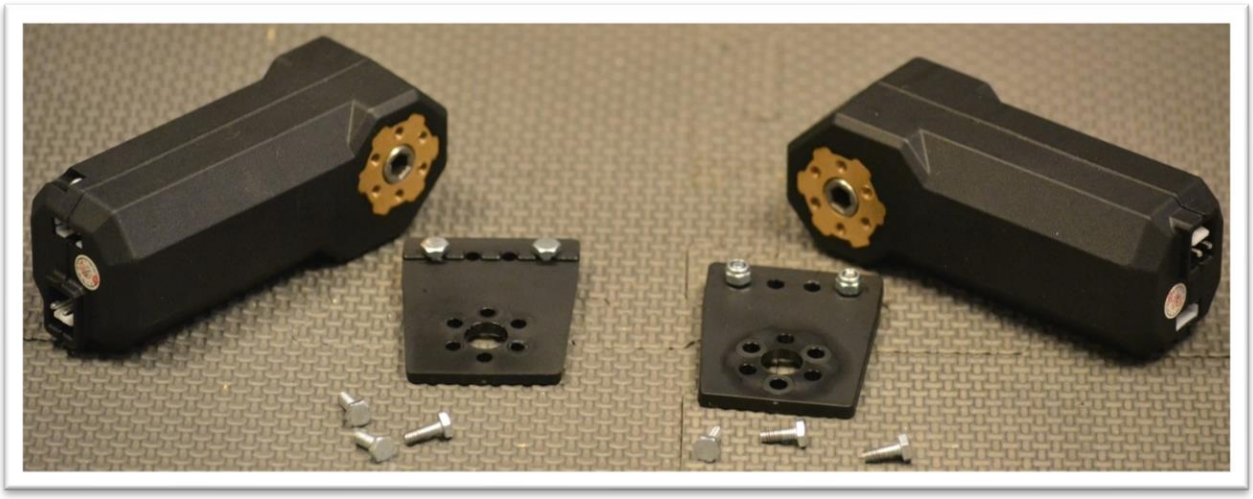

Figure 3- Unassembled view

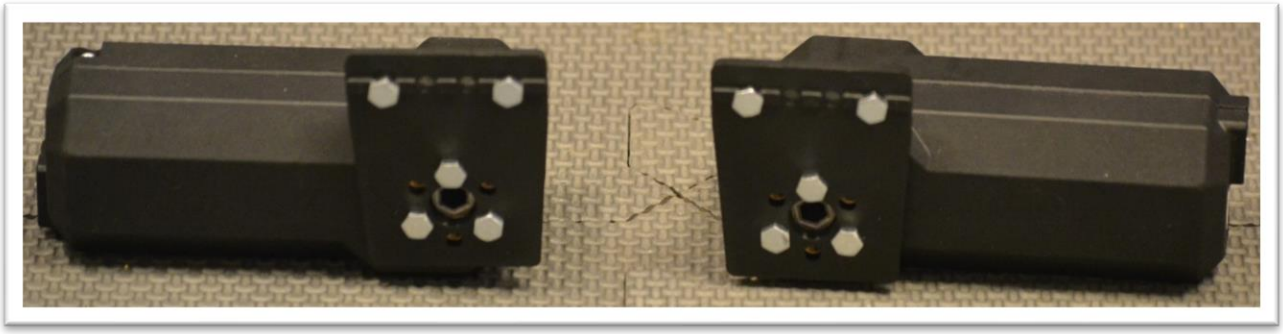

Figure 4- Assembled view

Helpful Hints

- Make sure that the brackets are facing the correct direction; the alignment ribs should be on the side away from the motor.
- Note that motor directions are reversed – the power plug of the motor pictured on the left is on the bottom; the plug of the motor on the right is on the top.

Step 3: Build the Right and Left Rail

Parts Needed:

REV-41-1432 – Extrusion, 420mm, 90-90 degree (1 per side, 2 total)
Motor Assemblies (1 per side, 2 total – from step 2)
Drive Bracket assemblies (1 per side, 2 total –the two remaining from step 1)
REV-41-1324 – Spacer, 3mm (3 per side, 6 total)
REV-41-1327 – Shaft Collar (1 per side, 2 total)
REV-41-1326 – Bearing, Through Bore, Short (1 per side, 2 total)
REV-41-1347 – Shaft, 5mm Hex, 75mm (1 per side, 2 total)

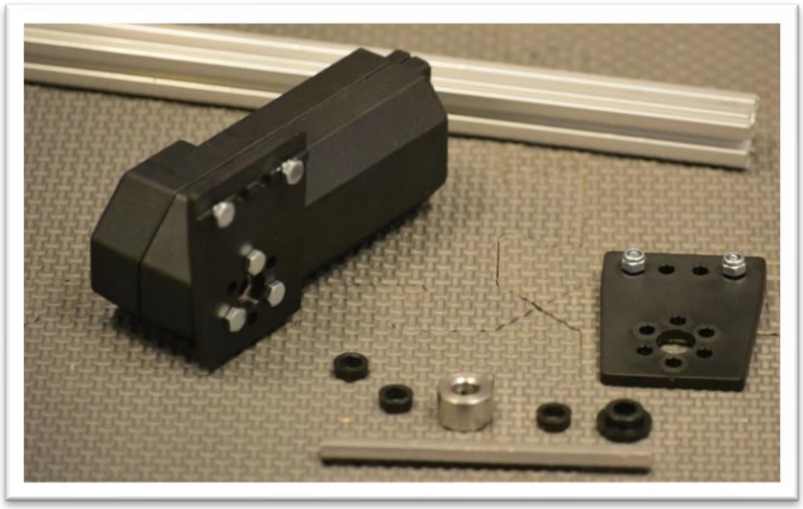

Figure 5- Unassembled view

Figure 6- Assembled view

Helpful Hints

- Slide the head of the screws down the center of the extrusions.
- The brackets should be flush with the end of the extrusions.
- bracket, bearing, spacer, collar, two spacers, bracket with attached motor. (Order from the outside in.)

Step 4: Add Drive Wheels

Parts Needed:

Rail Assemblies (1 per side, 2 total – from step 3)
REV-41-1354 – Wheel, Traction 90mm (1 per side, 2 total)
REV-41-1327 – Shaft Collar (1 per side, 2 total)
REV-41-1324 – Spacer, 3mm (1 per side, 2 total)

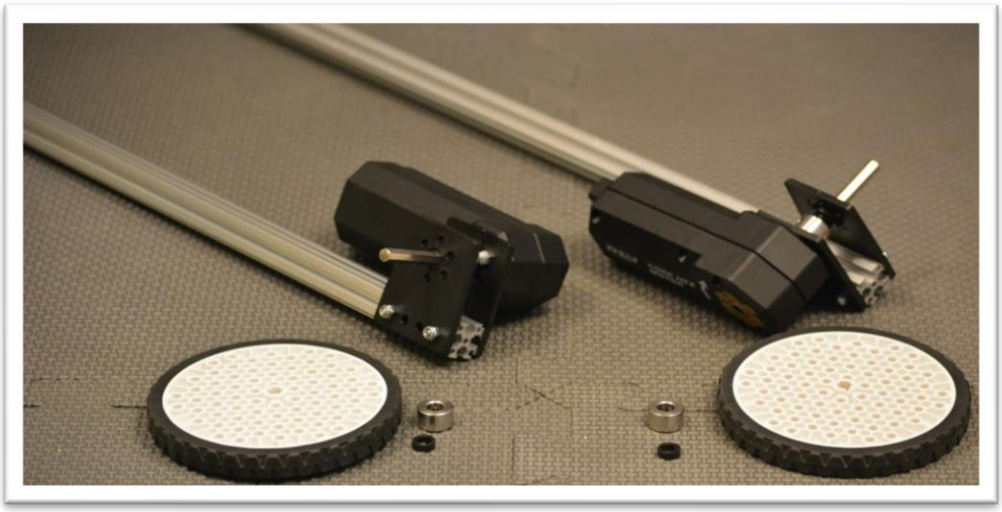

Figure 7- Unassembled View

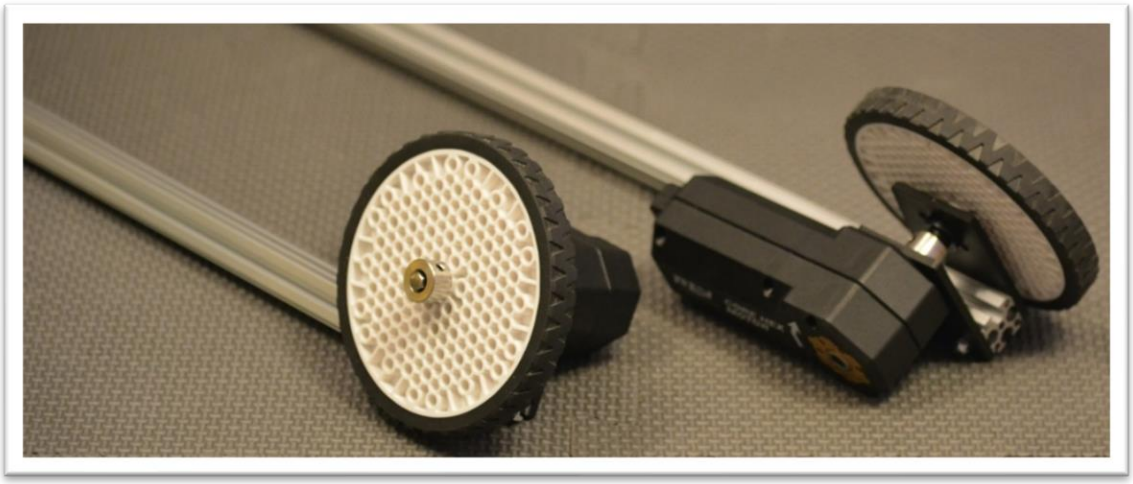

Figure 8- Assembled view

Helpful Hints

- Order from the outside in. (Collar, wheel, spacer, rail assembly.)
- Make sure that the wheels do not rub the nuts. If they do, then revisit previous steps to make sure the construction is accurate.
- Adjust axle length, so it is flush with the collar.

Back Support Beam

Step 1: Add Screws to Corner Brackets

Parts Needed:

REV-41-1320 – Bracket, Inside Corner (2)
REV-41-1359 – Screw, Hex Cap, M3, 8mm (8)
REV-41-1361 – Nut, Locking, M3 (8)

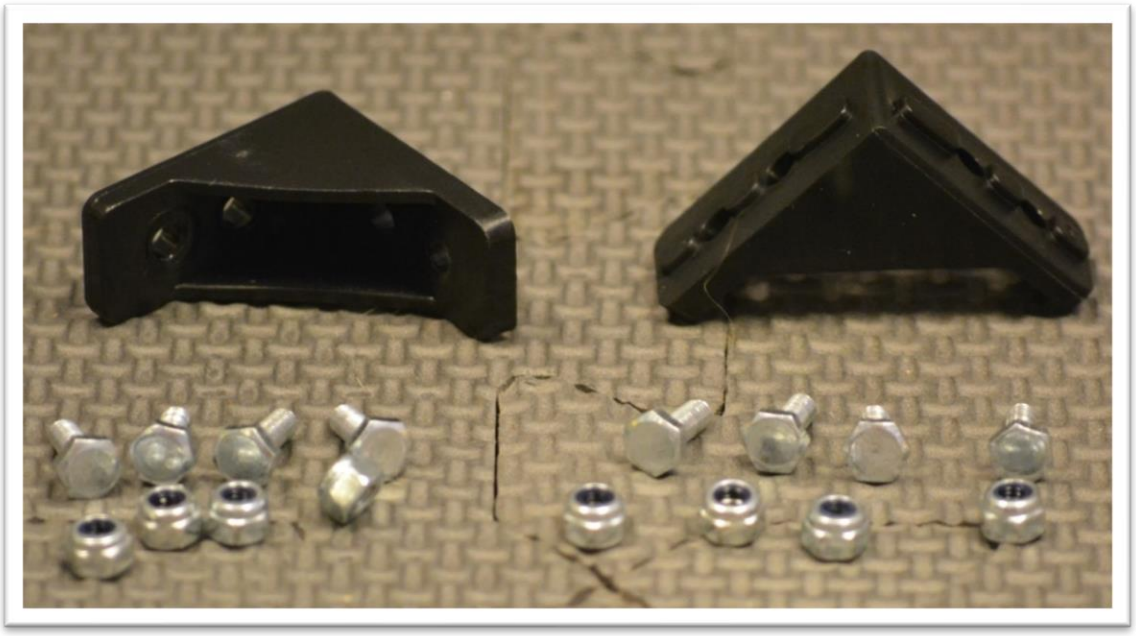

Figure 9- Unassembled view

Figure 10- Assembled view

Helpful Hints

- Screw the nuts onto the screws just until it's difficult to turn them; just so that the nuts don't fall off.
- The screw heads will need to slide along the center of an extrusion in a later step.

Step 2: Add Corner Brackets to Beam

Parts Needed:
REV-41-1431 – Extrusion, 225mm, 90-90 Degree (1)
Corner Bracket Assemblies (2 - from step 1)

Figure 11- Unassembled view

Figure 12- Assembled view

Helpful Hint

- Slide the head of the screws down the center of the extrusion.

Step 3: Add Floating Screws to Beam

Parts Needed:
Back Support Assembly (1 - from step 2)
REV-41-1359 – Screw, Hex Cap, M3, 8mm (2)

Figure 13- Unassembled view

Figure 14- Assembled view

Helpful Hint

- The two 8mm screws are loaded onto what will become the top face of the beam.

Step 4: Add Back Support Beam

Parts Needed:
Chassis (from Drive Assemblies and Frame, step 4)
Back Support Beam Assembly (from the previous step)

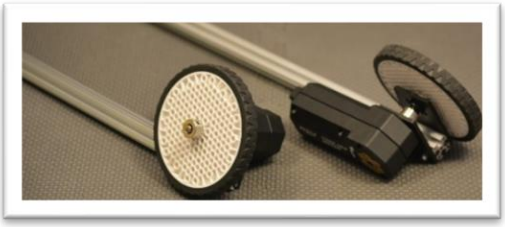

Figure 15- Unassembled view

Figure 16- Unassembled view

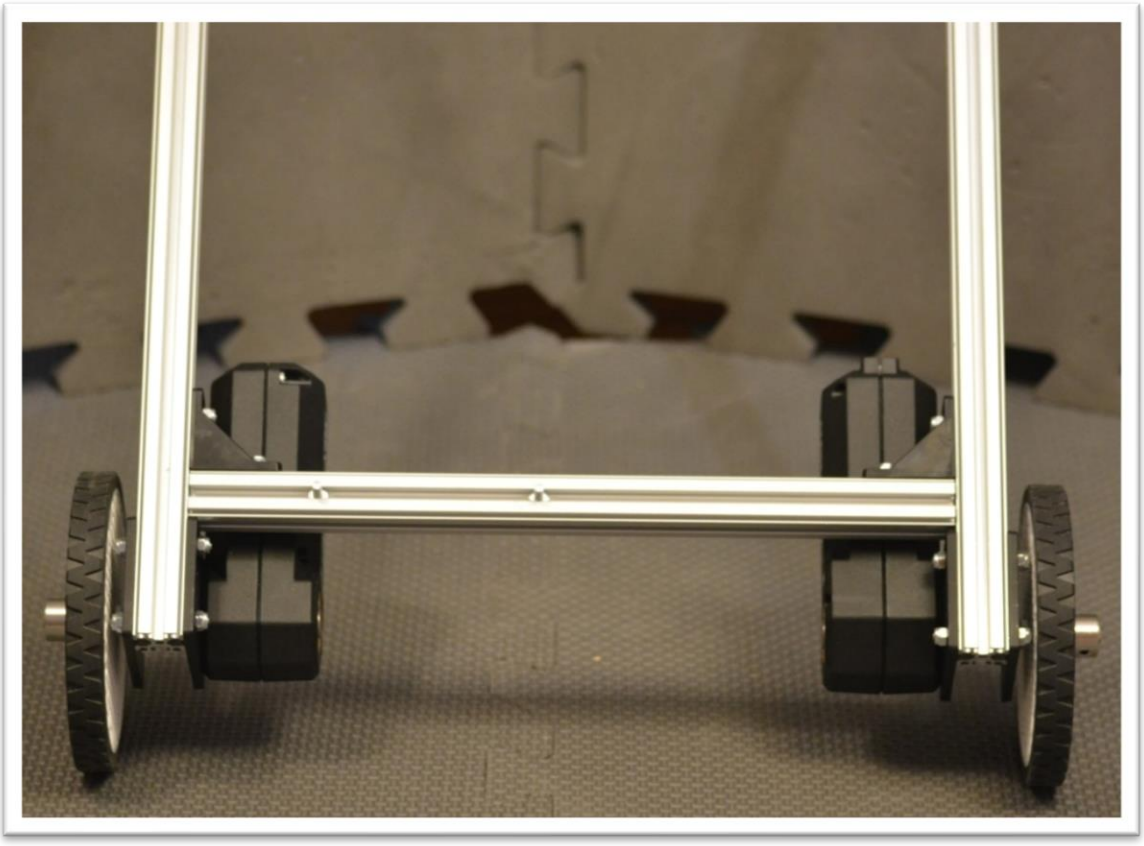

Figure 17- Assembled view

Helpful Hint

- The beam should touch the drive wheel brackets.

Front Support Beam

Step 1: Add Screws to Corner Brackets

Parts Needed:

REV-41-1320 – Bracket, Inside Corner (2)
REV-41-1359 – Screw, Hex Cap, M3, 8mm (8)
REV-41-1361 – Nut, Locking, M3 (8)

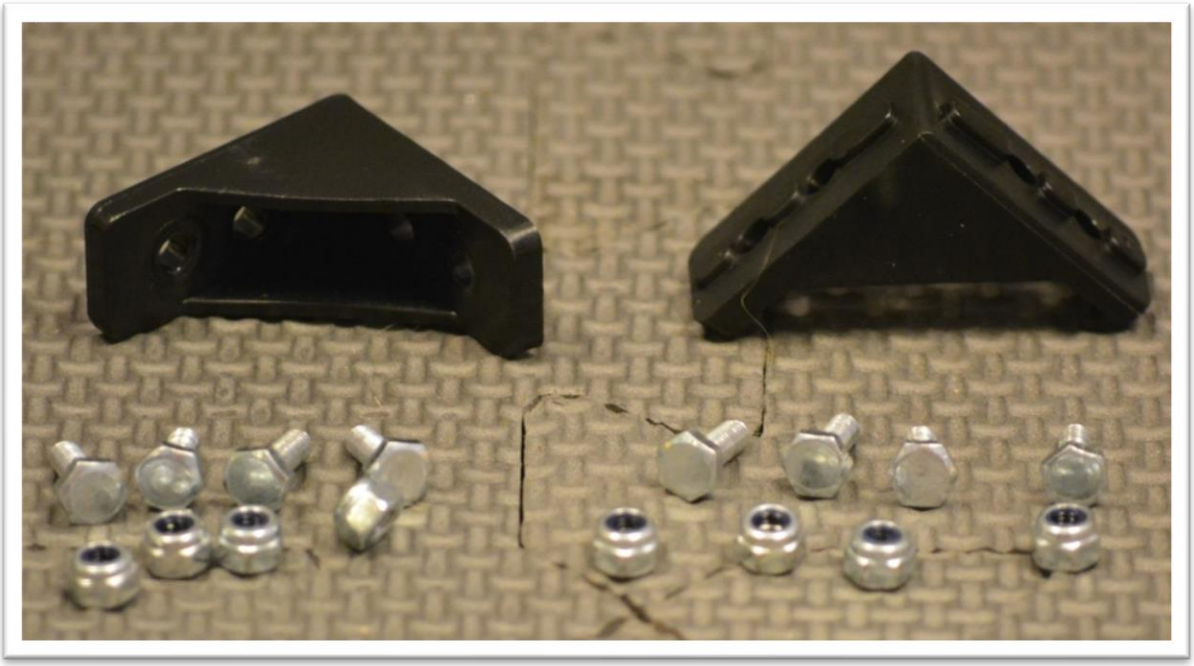

Figure 18- Unassembled view

Figure 19- Assembled view

Helpful Hint

- Screw the nuts onto the screws just until it's difficult to turn them; just so that the nuts don't fall off. The screw heads will need to slide along the center of an extrusion in a later step.

Step 2: Add Corner Brackets to Beam

Parts Needed:
REV-41-1431 – Extrusion, 225mm, 90-90 Degree (1)
Corner Bracket Assemblies (2 - from step 1)

Figure 20- Unassembled view

Figure 21- Assembled view

Step 3: Add Floating Screws to Beam

Parts Needed:
Front Beam Assembly (1 - from step 2)
REV-41-1359 – Screw, Hex Cap, M3, 8mm (2)
REV-41-1360 – Screw, Hex Cap, M3, 16mm (2)

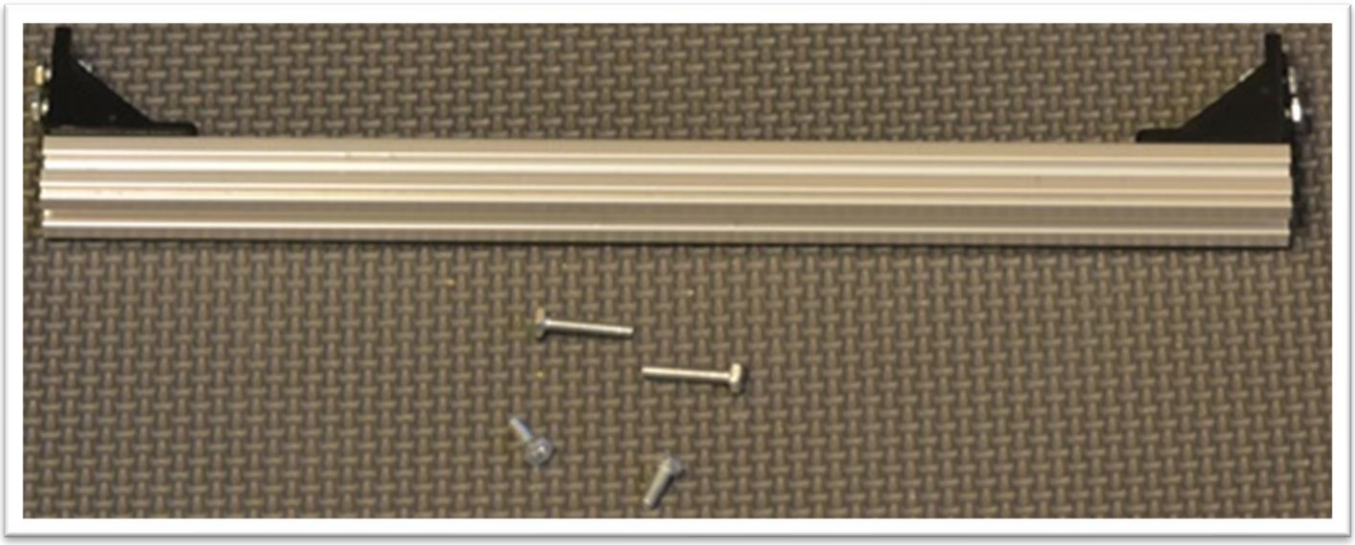

Figure 22- Unassembled view

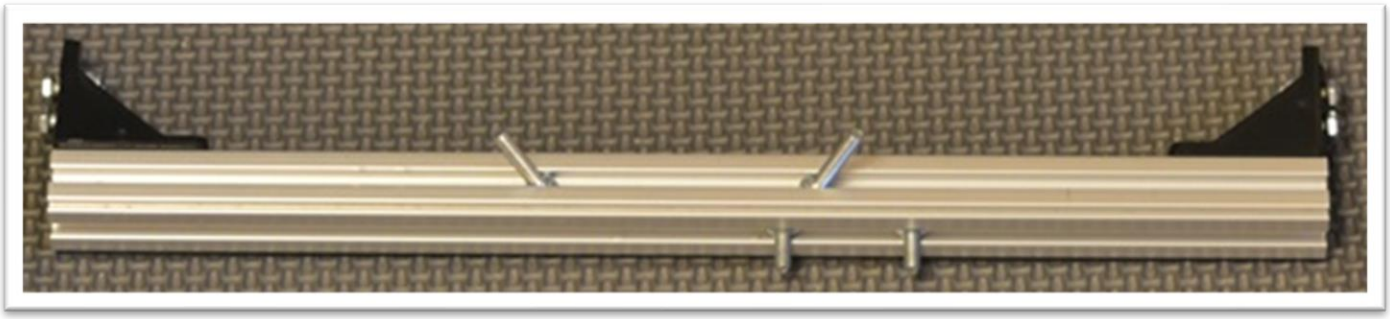

Figure 23- Assembled view

Helpful Hints

- Two of the 8mm screws are loaded onto what will become the front face of the beam.
- One of the 8mm and two of the 16mm screws are loaded onto what will become the top face of the beam

Step 4: Add Front Support Beam

Parts Needed:
Chassis (from Back Support Beam, step 4)
Front Support beam assembly (1 - from step 3)

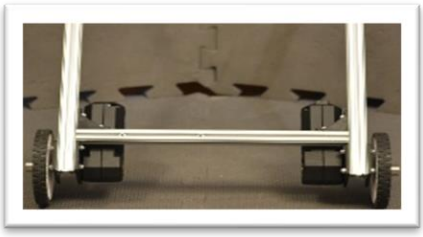

Figure 24- Unassembled view

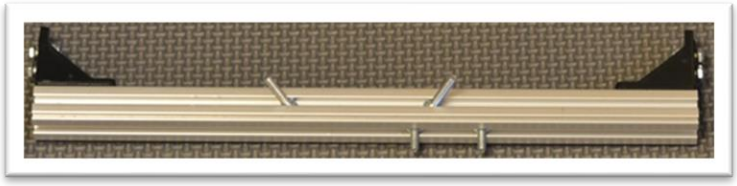

Figure 25- Unassembled view

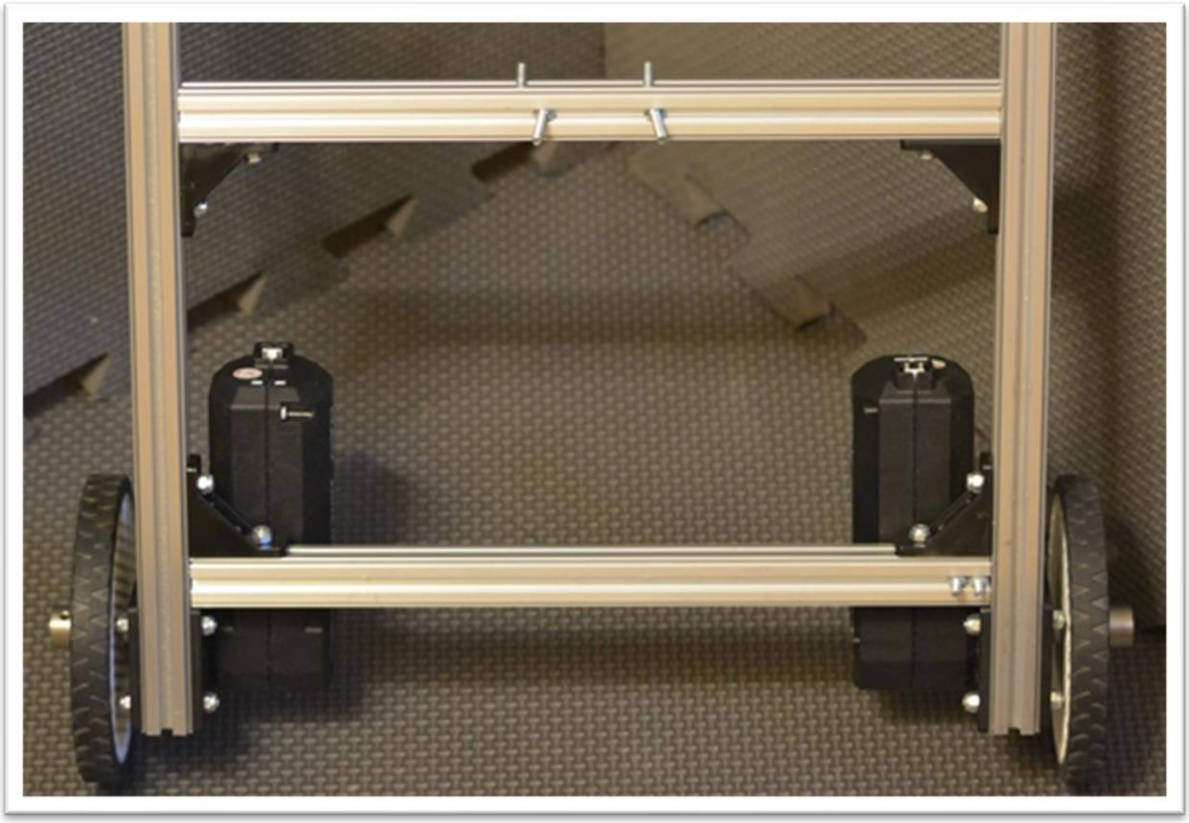

Figure 26- Assembled view

Helpful Hints

- There should be 121mm between the back support beam and the front support beam (there will be 136mm center to center).
- If a ruler is not available, the position may need to be adjusted in a later step.

Step 5: Add Switch Bracket

Parts Needed:
Chassis Switch Plate (part of REV-31-1387)
REV-41-1361 – Nut, Locking, M3 (2)

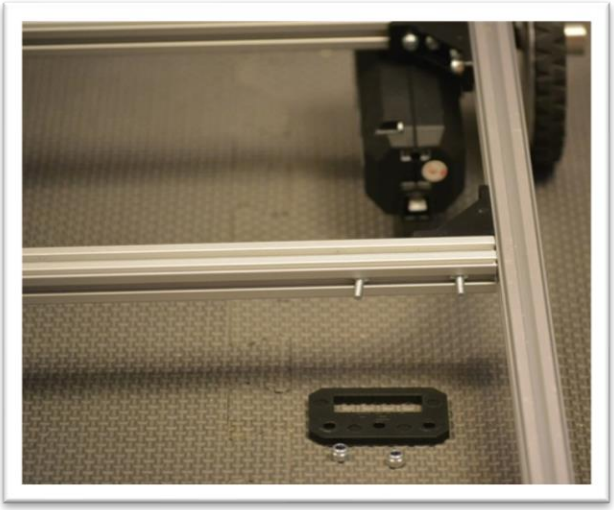

Figure 27- Unassembled view

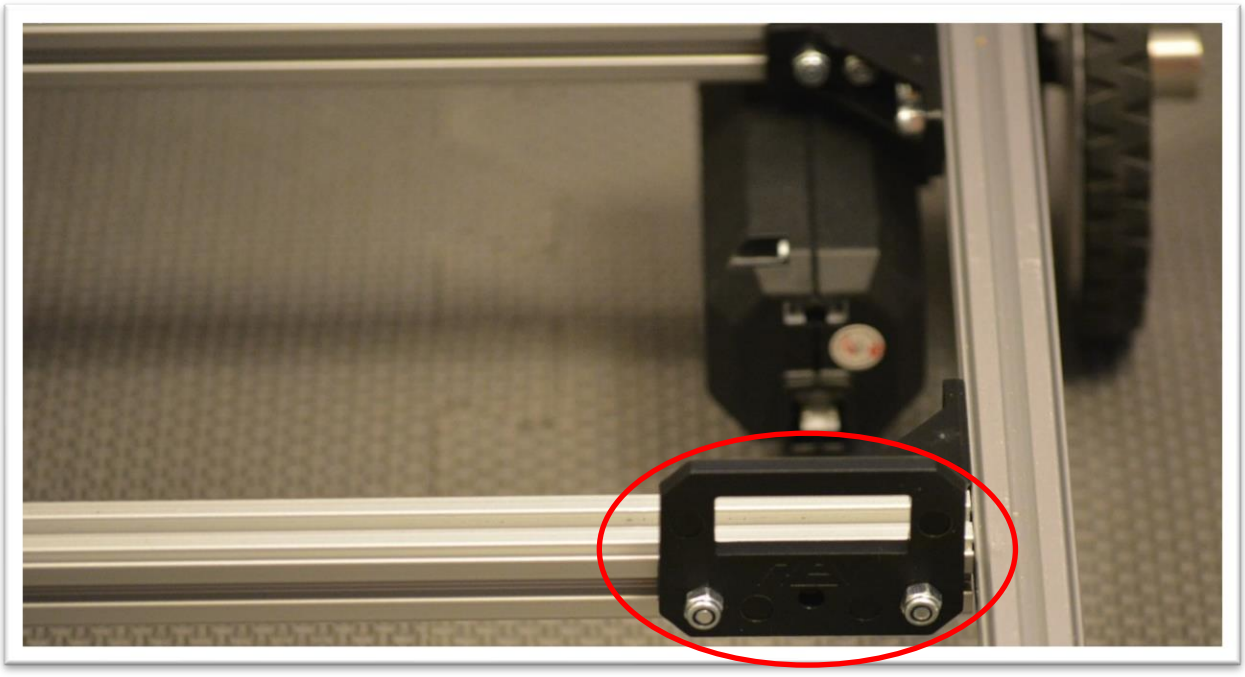

Figure 28- Assembled view

Caster Wheels

Step 1: Build Caster Brackets

Parts Needed:

REV-41-1303 – Bracket, Motion (2 per side, 4 total)
REV-41-1361 – Nut, Locking, M3 (2 per bracket, 4 per side, 8 total)
REV-41-1359 – Screw, Hex Cap, M3, 8mm (2 per bracket, 4 per side, 8 total)

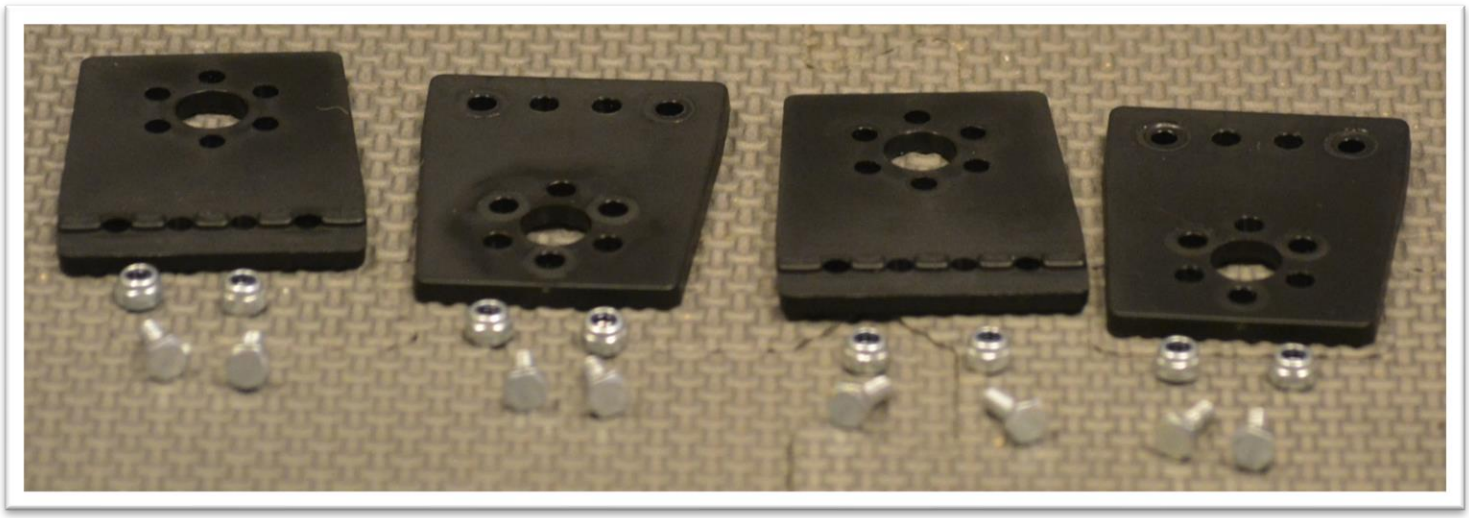

Figure 29- Unassembled view

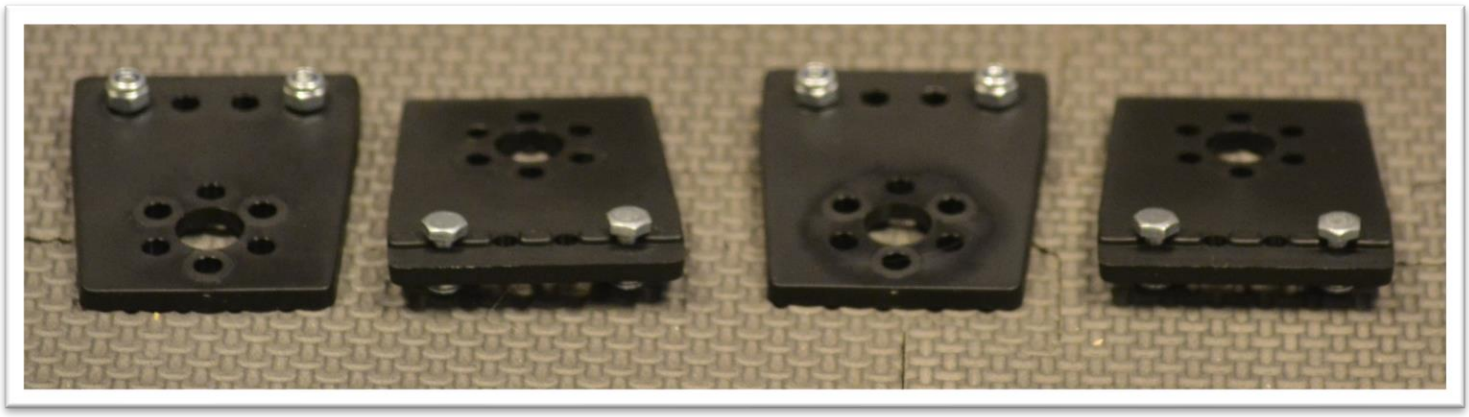

Figure 30- Assembled view

Helpful Hints

- Screw the nuts onto the screws just until it's difficult to turn them; just so that the nuts don't fall off.
- The screw heads will need to slide along the center of an extrusion in a later step.

Step 2: Add Caster Brackets to Chassis

Parts Needed:
Caster Bracket Assemblies
(4 – from the previous step)

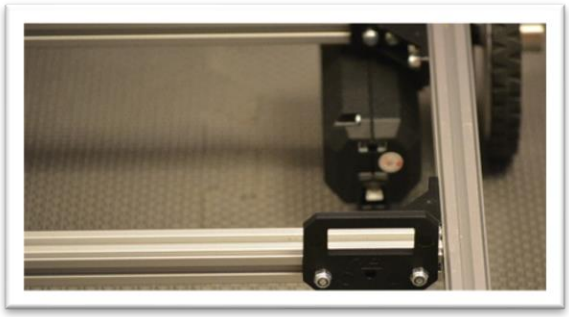

Figure 31- Unassembled view

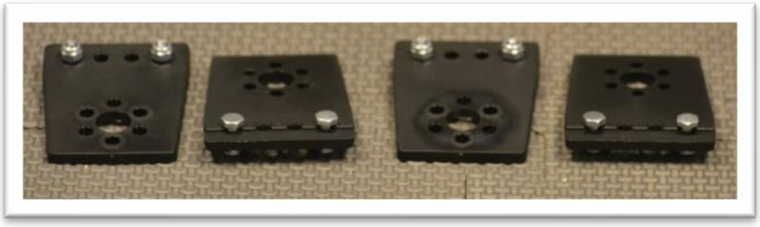

Figure 32- Unassembled view

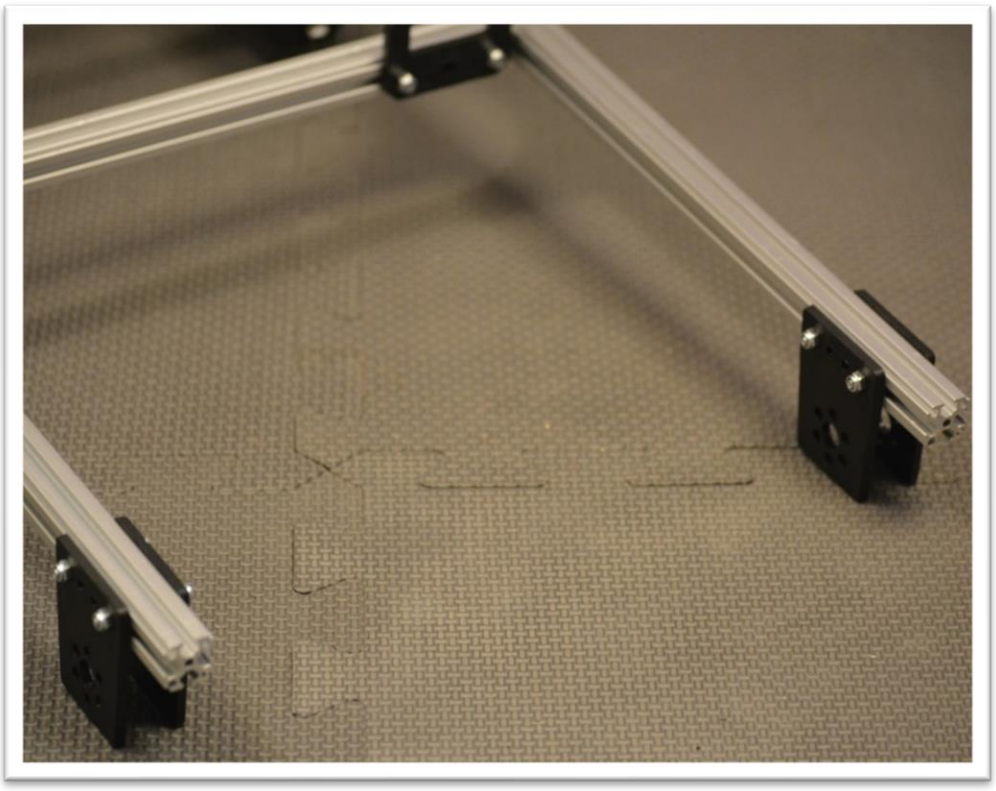

Figure 33- Assembled view

Helpful Hints

- Brackets must be installed 2 cm from the end of the extrusion, if used for competition, to fit within the sizing cube.
- Ensure that the pair of brackets on the same extrusion are the same distance from the end of the extrusion or the wheels will not rotate properly.

Step 3: Add the Omni Wheels

Parts Needed:

REV-41-1327 – Shaft Collar (2 per side – 4 total)
REV-41-1326 – Bearing, Through Bore, Short (2 per side – 4 total)
REV-41-1323 – Spacer, 15mm (1 per side – 2 total)
REV-41-1324 – Spacer, 3mm (1 per side – 2 total)
REV-41-1347 – Shaft, 5mm Hex, 75mm (1 per side – 2 total)
REV-41-1190 – Wheel, Omni 90mm (1 per side – 2 total)

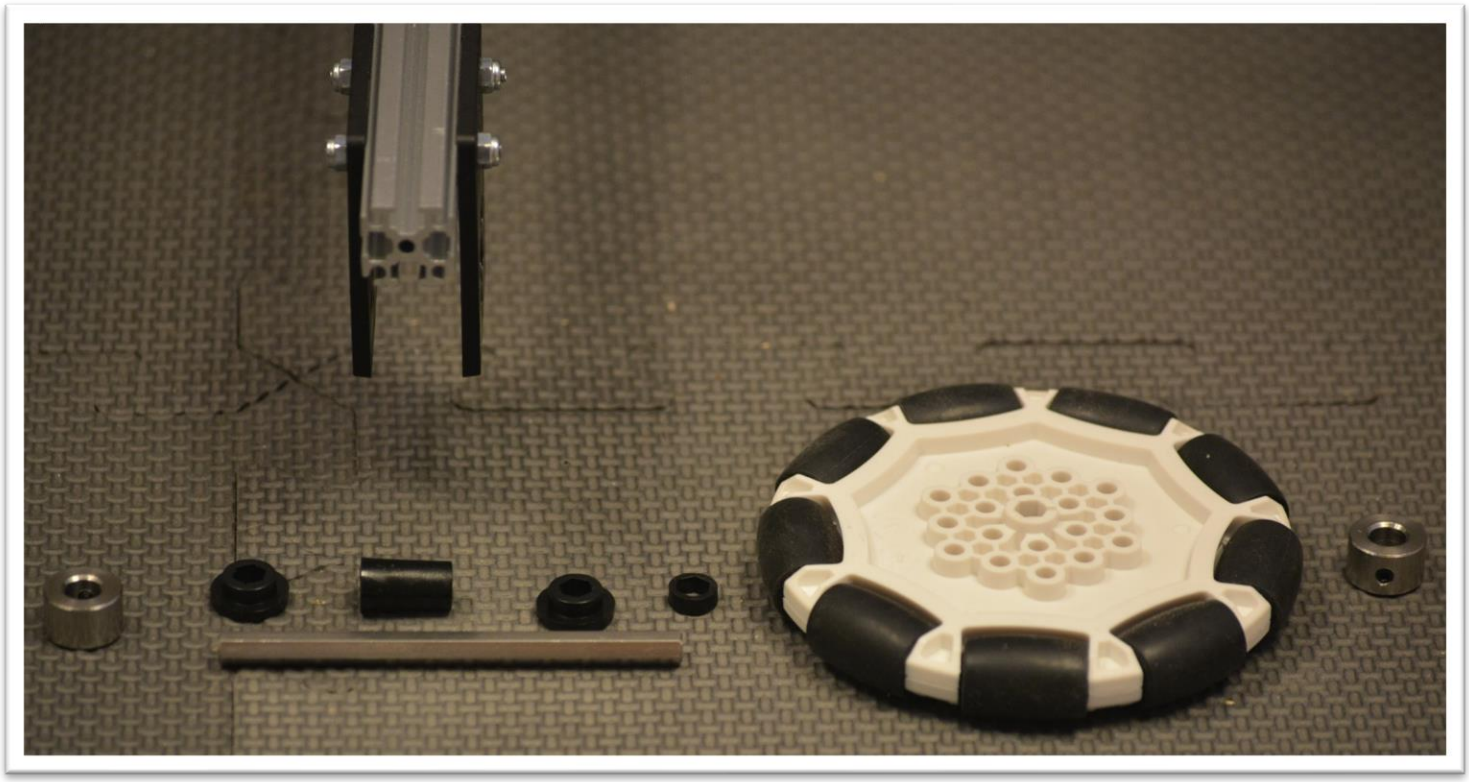

Figure 34- Unassembled view of left wheel

[Continued on the next page, so detail can be seen more easily.]

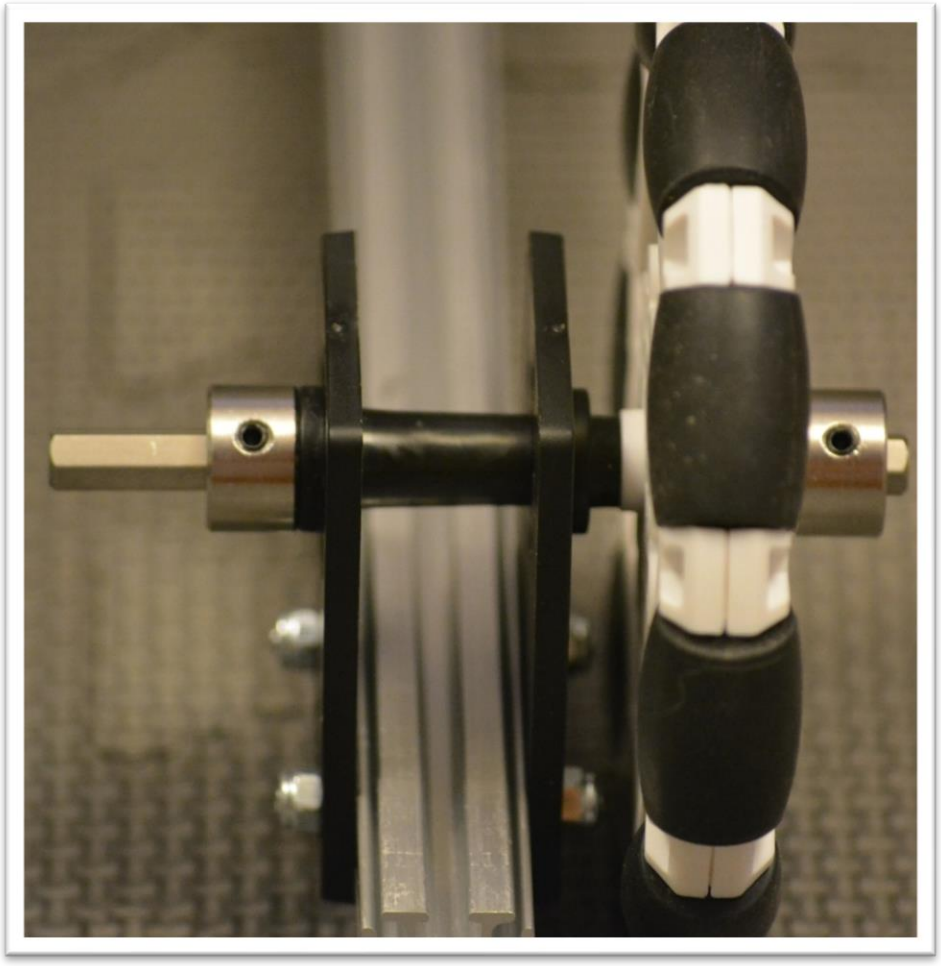

Figure 35- Assembled view of right wheel

Helpful Hints

- Order from the outside in: collar, omni wheel, 3mm spacer, bearing, bracket, 15mm spacer, bracket, bearing, collar.
- Adjust axle length, so it is flush with the collar.

[Continued on the next page, so detail can be seen more easily.]

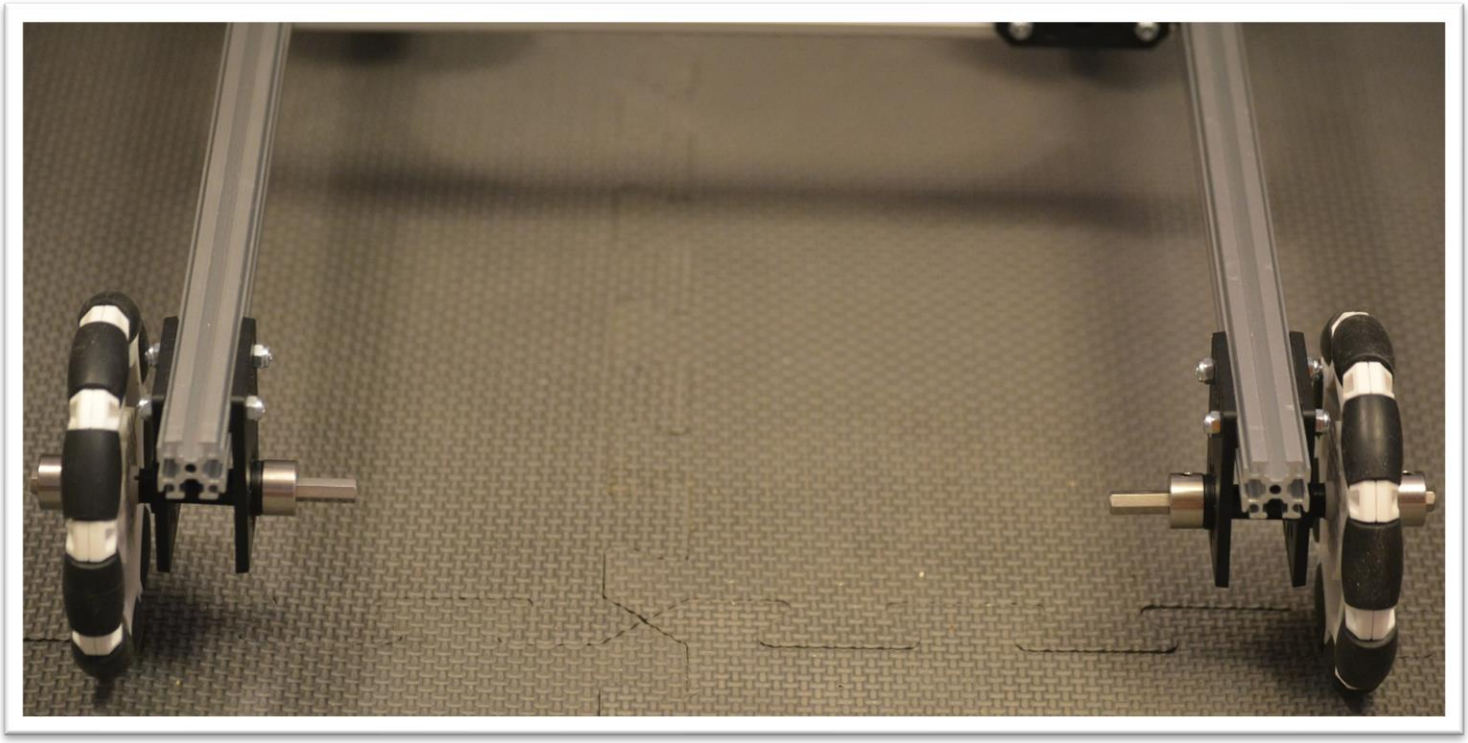

Figure 36- Assembled view

Control Hub

Step 1: Add the Support Plate

Parts Needed:
REV-41-1166 – Battery Holder Plate (1)
REV-41-1361 – Nut, Locking, M3 (2)

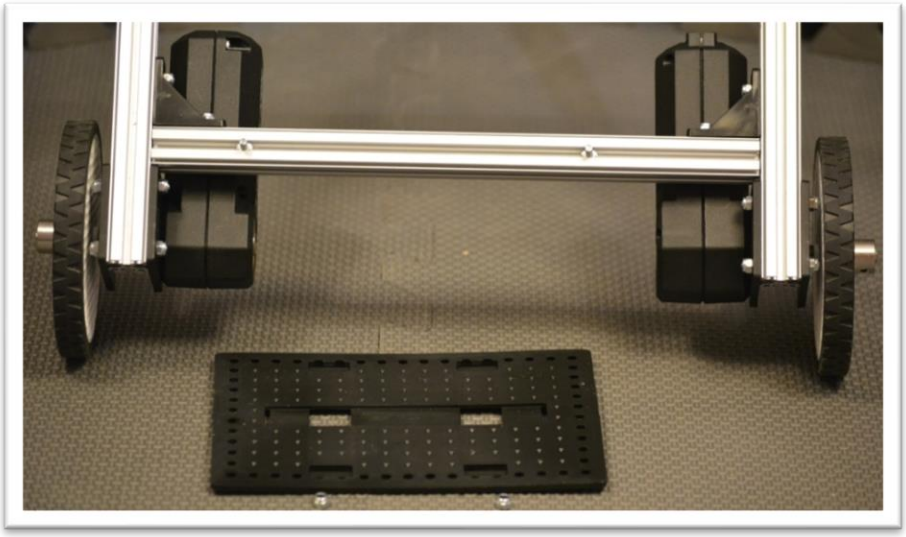

Figure 37- Unassembled view

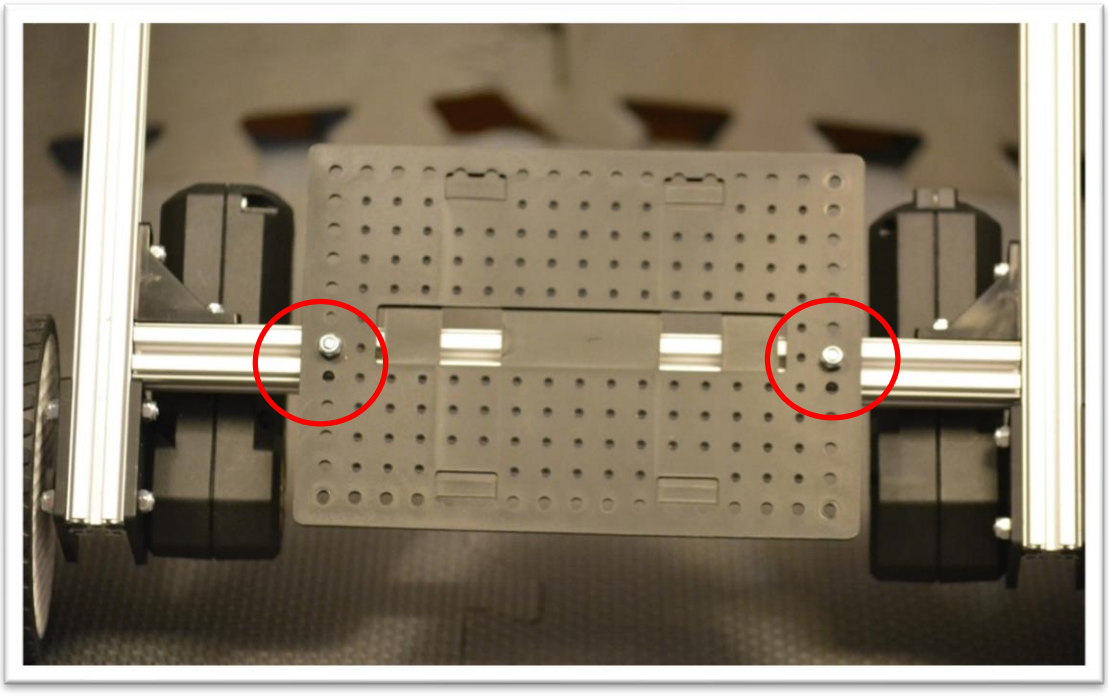

Figure 38- Assembled view

Step 2: Add the Rev Robotics Control Hub

Parts Needed:

REV-31-1153 – Control Hub (1)
REV-41-1360 – Screw, Hex Cap, M3, 16mm (2) (two other screws are already in the extrusion from an earlier step)
REV-41-1361 – Nut, Locking, M3 (4)

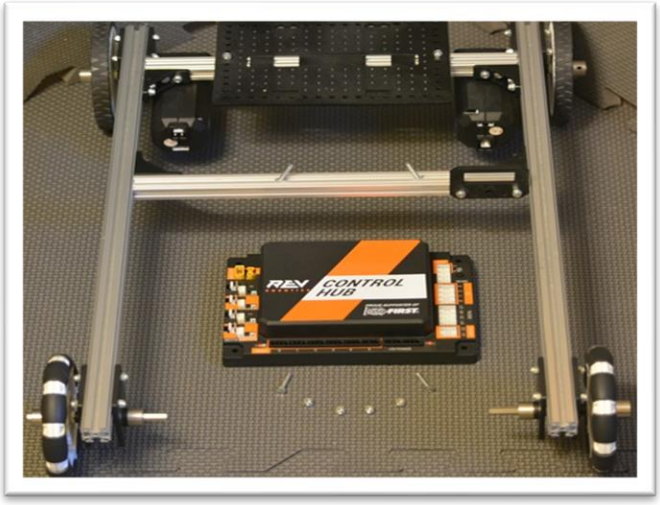

Figure 39- Unassembled view

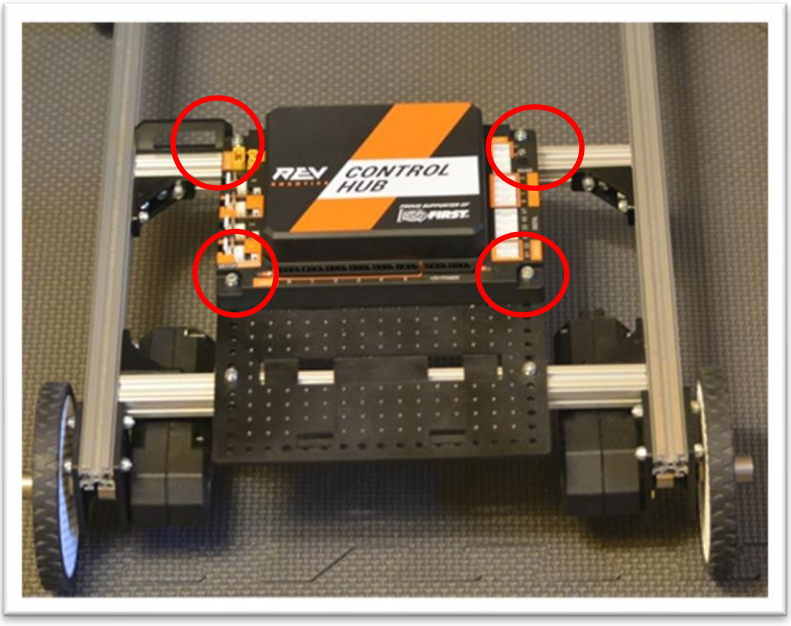

Figure 40- Assembled view

Helpful Hints

- Reposition the front support beam, if necessary, to accomplish the proper spacing – the two floating screws on the front beam need to be at the corners of the control hub.

Step 3: Add the Left Drive Motor Power Cable

Parts Needed:

Motor Power Cable (1 – comes with the core hex motor – REV-41-1300)

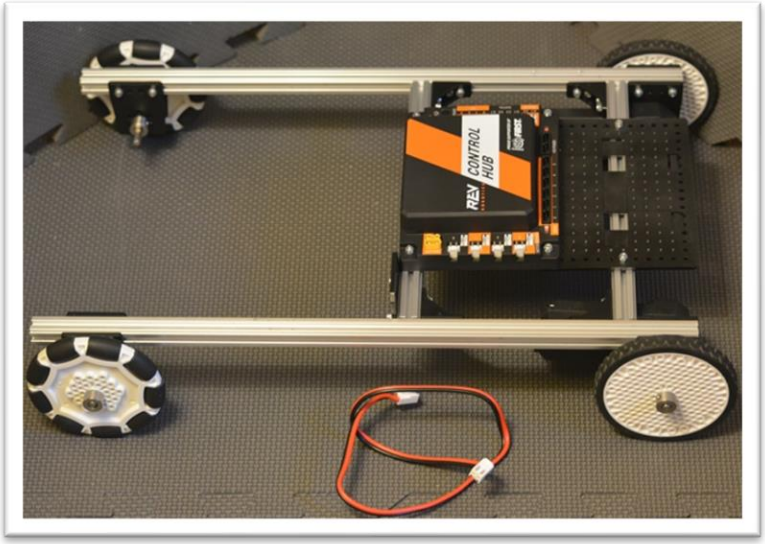

Figure 41- Unconnected view

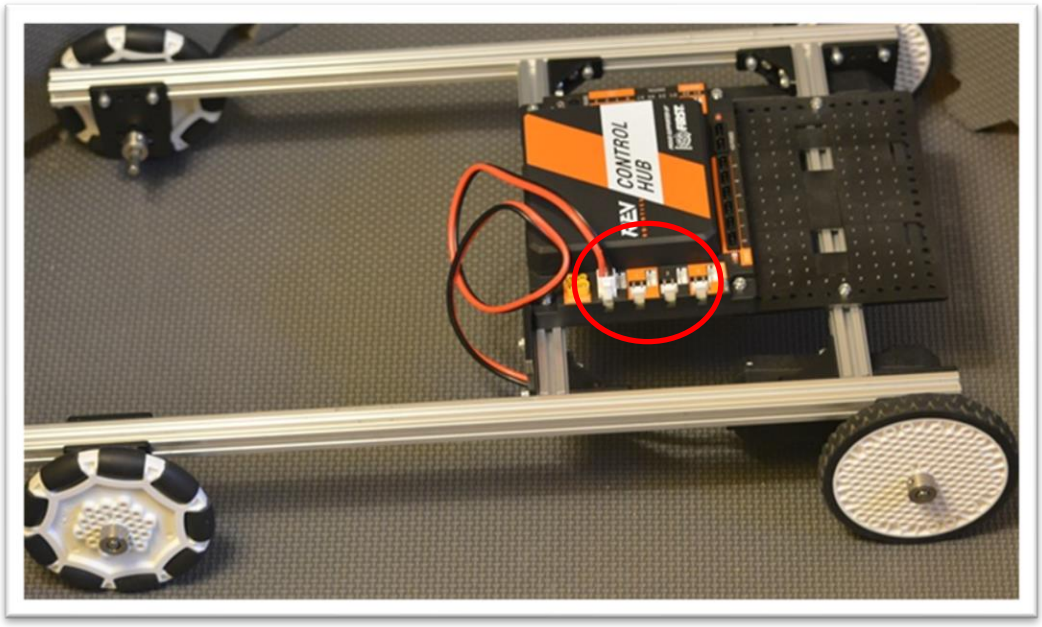

Figure 42- Connected view

Step 4: Add the Right Drive Motor Power Cable

Parts Needed:

Motor Power Cable (1 – comes with the core hex motor – REV-41-1300)

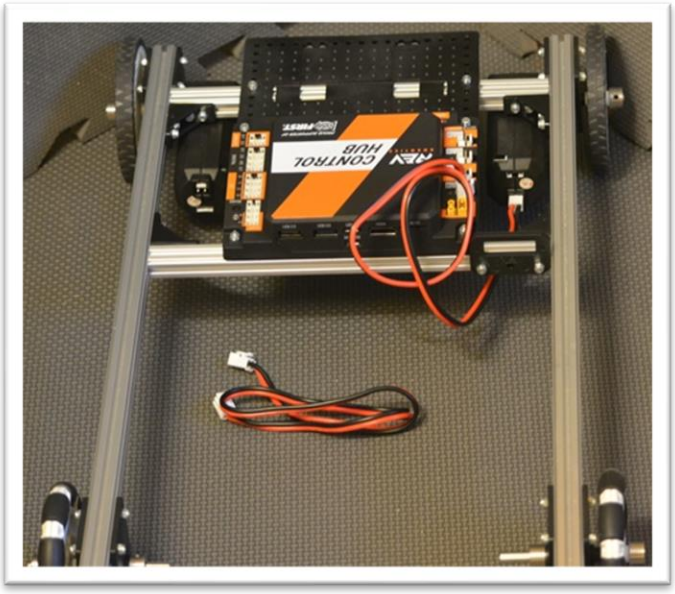

Figure 43-Unconnected view

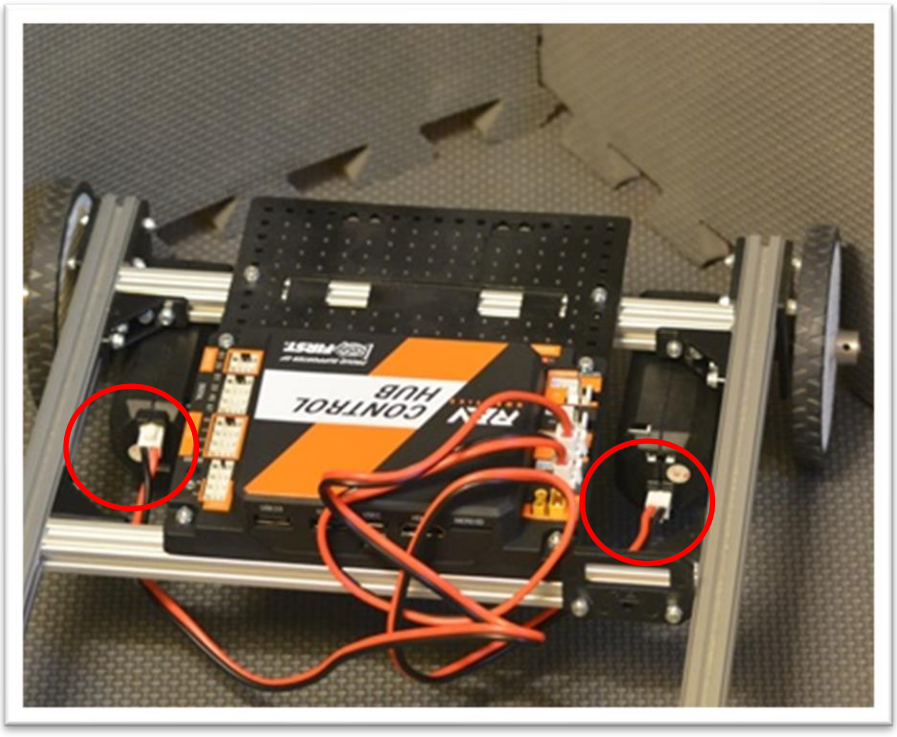

Figure 44- Connected view

Power Switch

Step 1: Add the Switch

Parts Needed:
REV-41-1303 – Bracket, Motion (4)
REV-41-1361 – Nut, Locking, M3 (8)
REV-41-1359 – Screw, Hex Cap, M3, 8mm (8)

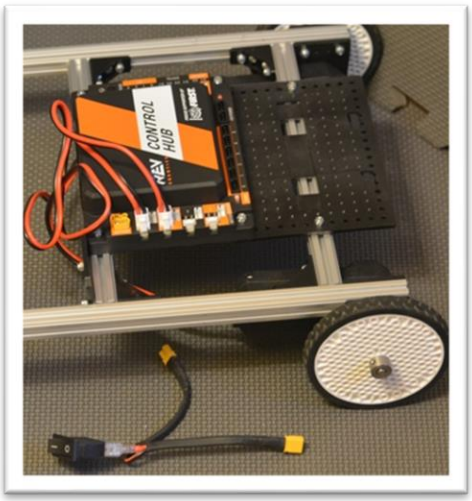

Figure 45- Unconnected view

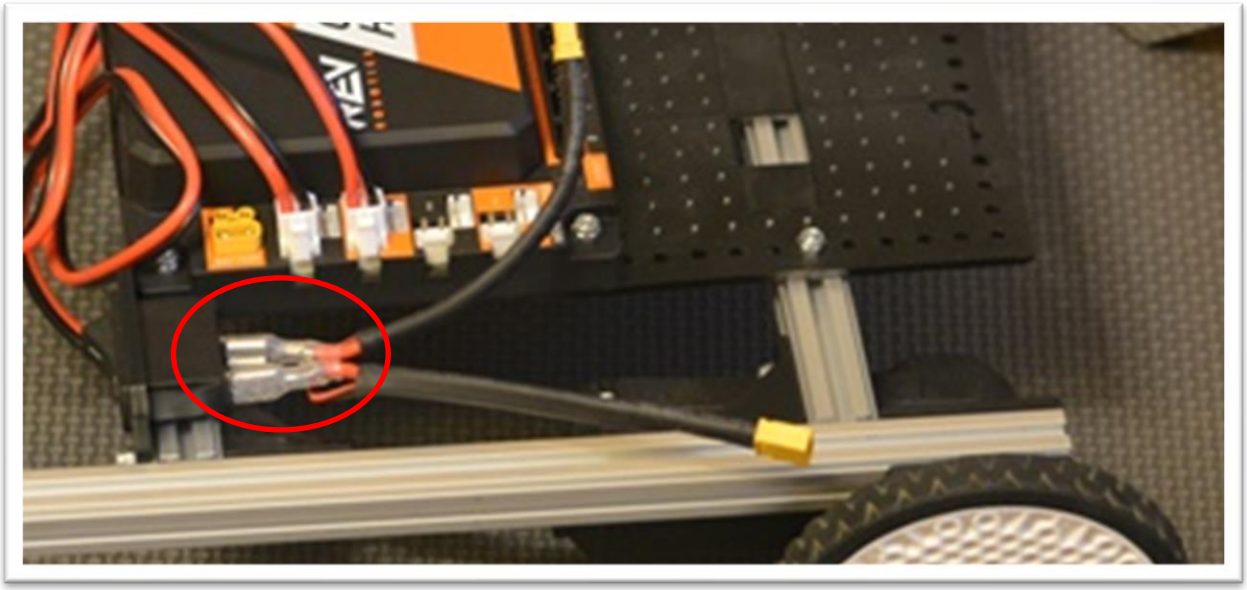

Figure 46- Connected view

Step 2: Connect the Switch to the Control Hub

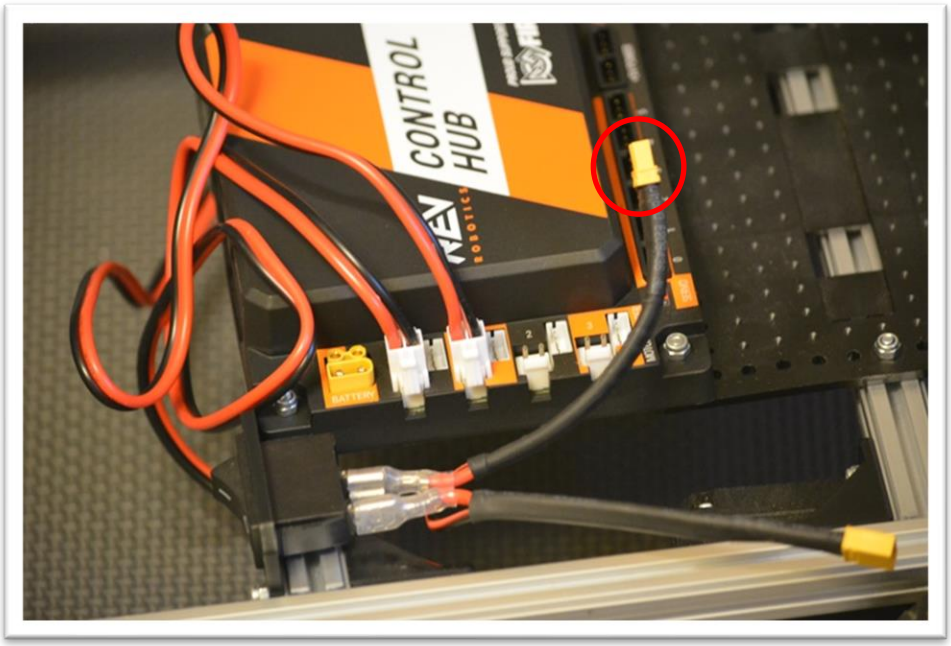

Figure 47- Unconnected view

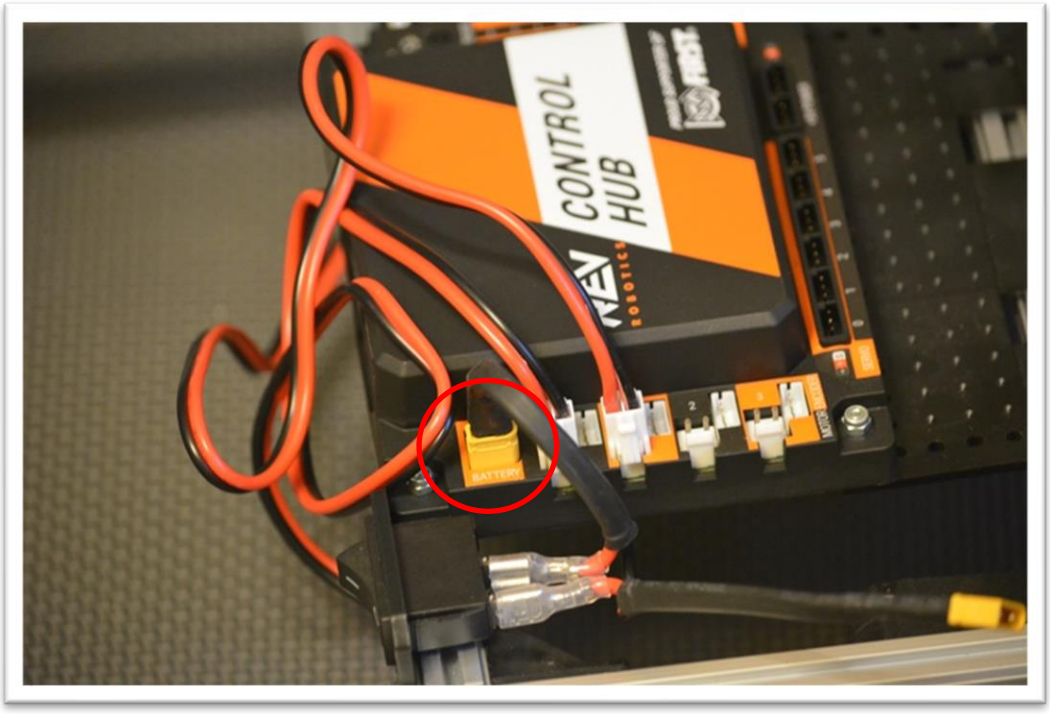

Figure 48- Connected view

Battery

Step 1: Add the Battery

Parts Needed:
REV-31-1302 – Slim Battery, 3000mAh (1)
REV-41-1161 – Zip Tie, 160mm (2)

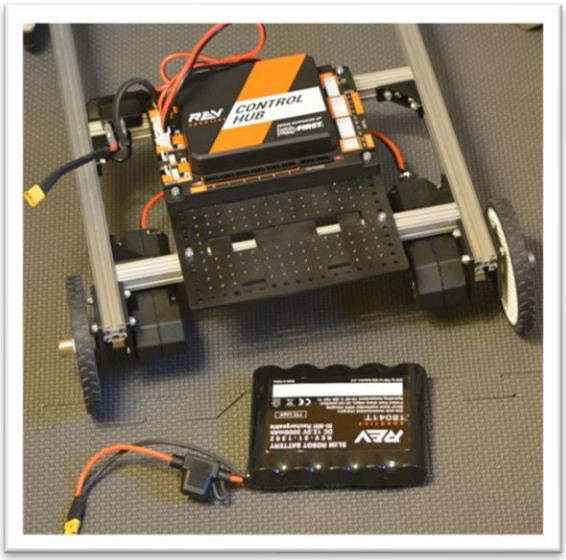

Figure 49- Unassembled view

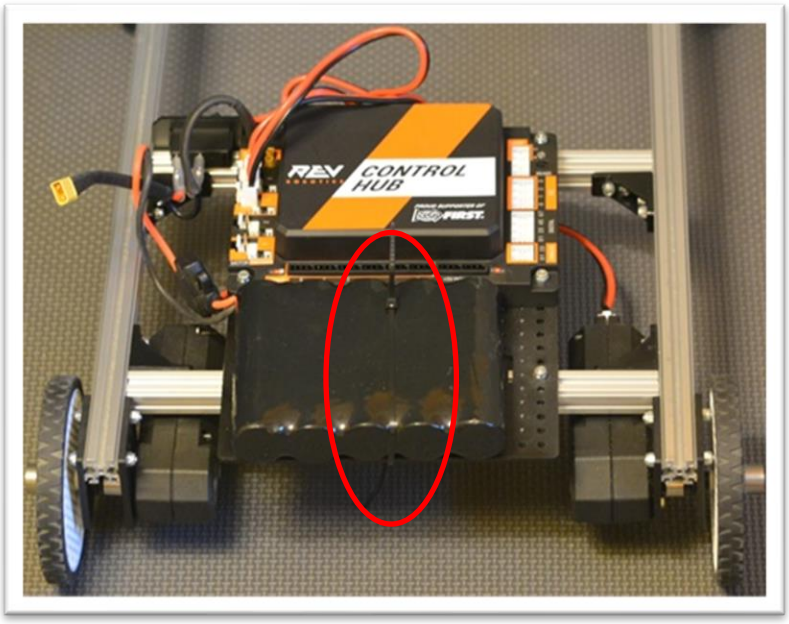

Figure 50- Assembled view

Step 2: Connect the Battery to the Switch

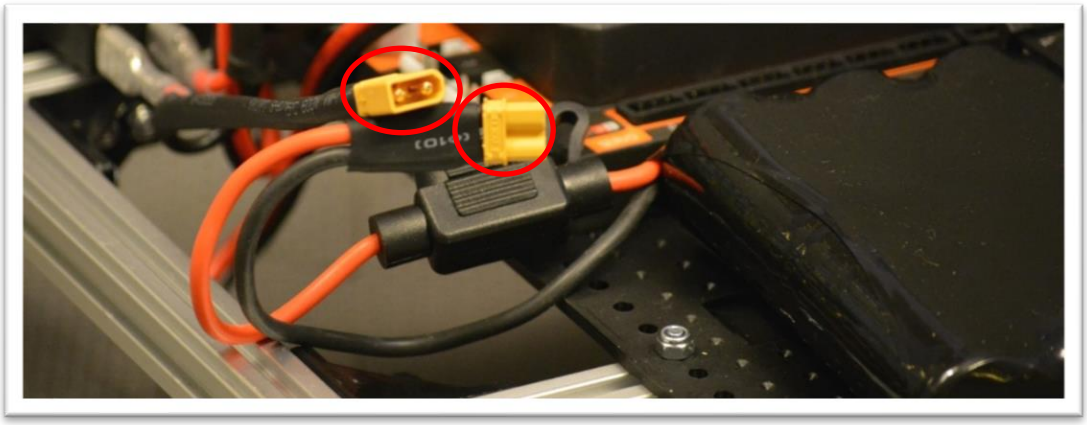

Figure 51- Unconnected view

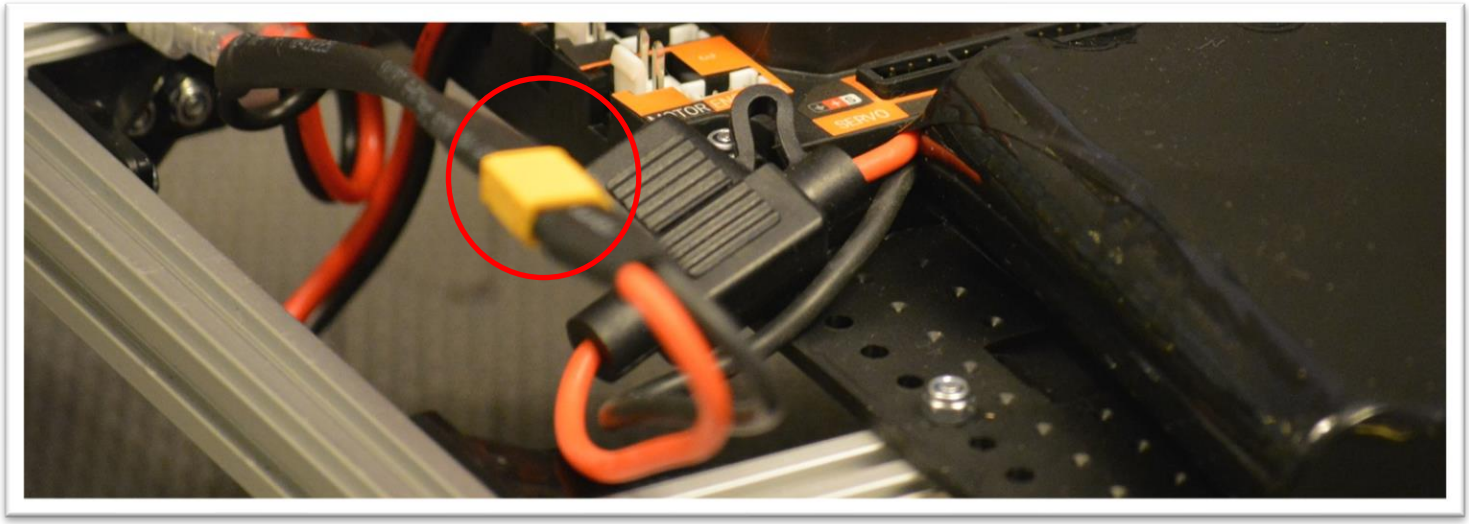

Figure 52- Connected view

Final Steps

What's Next?

- You have now constructed the frame of your Basic 'Bot, however, programming will be needed to make the robot functional.
- Testing should be done to determine whether anything needs to be changed or optimized for the season's game rules. Testing will also show whether more cables need to be secured or re-routed.
- Check the game rules for all the applicable stickers
- Make sure to also go over the robot checklists:
  - Robot Self-Inspection Checklist
  - Robot Reliability Checklist

Resources

Visit the FIRST website for programming resources, robot building resources, more instructions and game rules.

The robot can be even better with armature. Watch for the release (later in the season) of the Basic 'Bot Armature Guide by visiting our website (www.ssirobotics.lydean-david.net/) or Facebook page (www.facebook.com/ssirobotics/).

Appendix A – Resources

Game Forum Q&A

https://ftc-qa.firstinspires.org/

Anyone may view questions and answers within the *FIRST*® Tech Challenge game Q&A forum without a password. To submit a new question, you must have a unique Q&A system user name and password for your team.

Volunteer Forum

Volunteers can request access to role specific volunteer forums by emailing FTCTrainingSupport@firstinspires.org. You will receive access to the forum thread specific to your role.

FIRST Tech Challenge Game Manuals

Part 1 and 2 - https://www.firstinspires.org/resource-library/ftc/game-and-season-info

FIRST Headquarters Pre-Event Support

Phone: 603-666-3906
Mon – Fri
8:30am – 5:00pm
Email: Firsttechchallenge@firstinspires.org

FIRST Websites

FIRST homepage – www.firstinspires.org

FIRST Tech Challenge Page – For everything *FIRST* Tech Challenge.

FIRST Tech Challenge Volunteer Resources – To access public volunteer manuals.

FIRST Tech Challenge Event Schedule – Find *FIRST* Tech Challenge events in your area.

FIRST Tech Challenge Social Media

FIRST Tech Challenge Twitter Feed - If you are on Twitter, follow the *FIRST* Tech Challenge Twitter feed for news updates.

FIRST Tech Challenge Facebook page - If you are on Facebook, follow the *FIRST* Tech Challenge page for news updates.

FIRST Tech Challenge YouTube Channel – Contains training videos, game animations, news clips, and more.

FIRST Tech Challenge Blog – Weekly articles for the *FIRST* Tech Challenge community, including outstanding volunteer recognition!

FIRST Tech Challenge Team Email Blasts – contain the most recent *FIRST* Tech Challenge news for teams.

Feedback

We strive to create support materials that are the best they can be. If you have feedback about this manual, please email firsttechchallenge@firstinspires.org. Thank you!