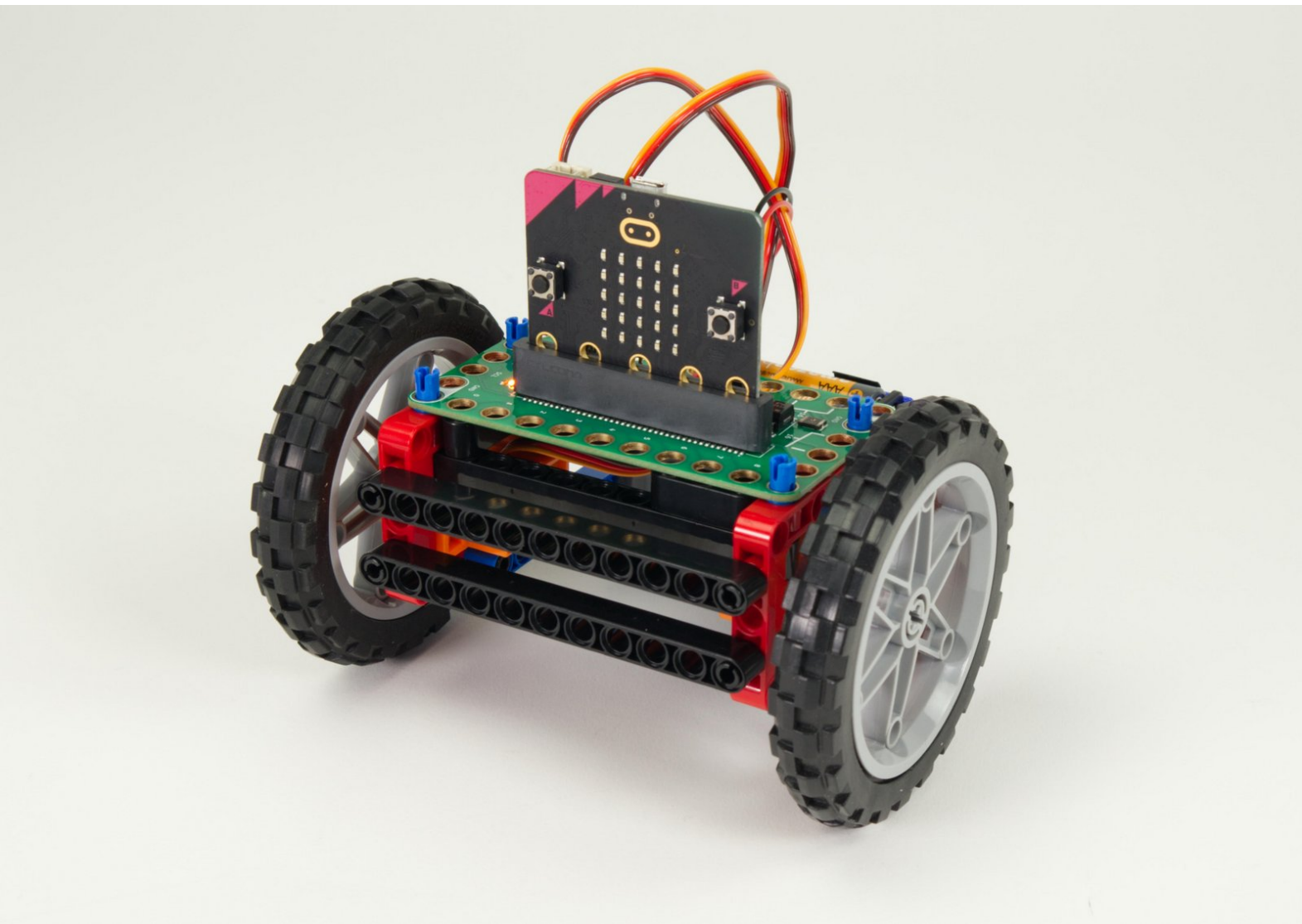




Rover Main Body

Use LEGO Technic components along with our Bit Board, a micro:bit, and two servos to build and program a rolling rover.

Written By: Pete Prodoehl



INTRODUCTION

Let's build a Rover! This project uses a set of LEGO Technic components along with our Bit Board, a micro:bit, and two servos to build and program a rolling Rover.

Once you have your Rover built other guides will show you how to extend the programming and add accessories and capabilities to the Rover.



TOOLS:

- [Computer](#) (1)



PARTS:

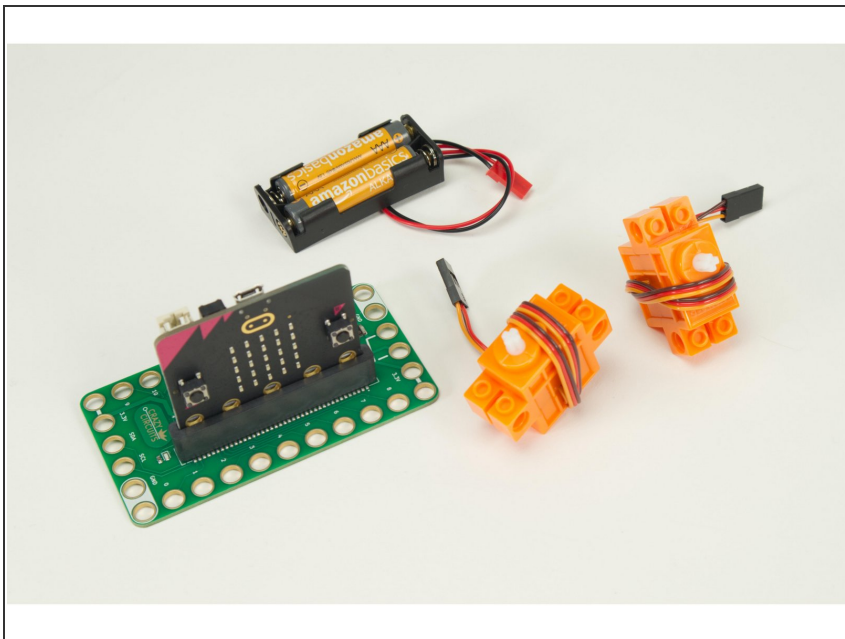
- [Crazy Circuits Bit Board](#) (1)
- [micro:bit](#) (1)
- [Brick Compatible 360 Degree Servo](#) (2)

Step 1 — Gather LEGO Components



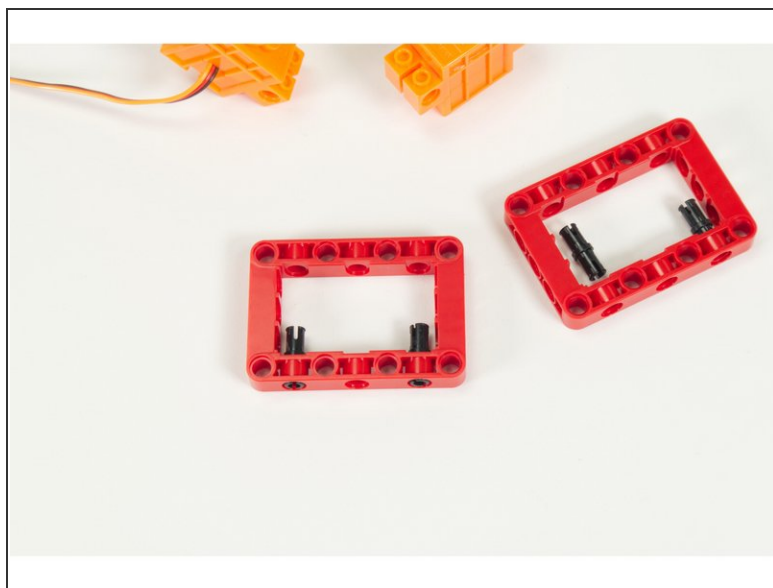
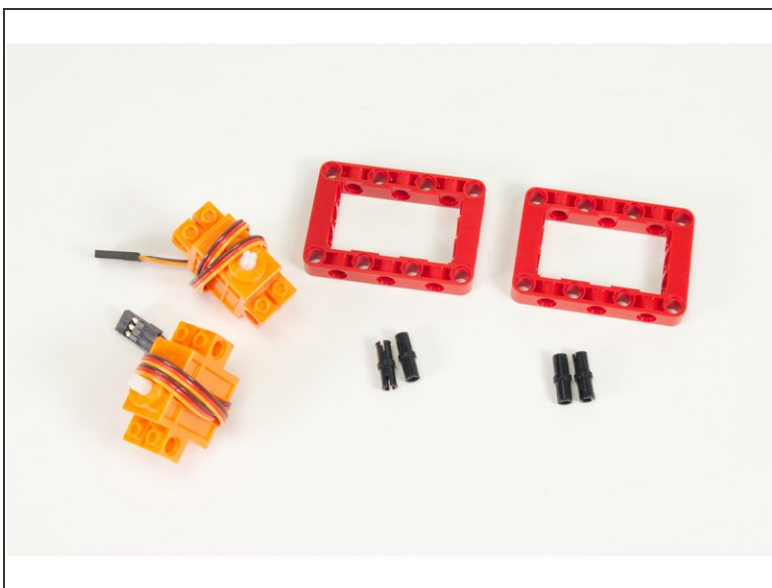
- Gather the parts needed to assemble the rover.
- Besides the beams, pins, frames, and other pieces there are two large wheels, and one 3D printed part.
- The battery pack holder is a Technic-compatible 3D printed part that we'll use to hold the rover's battery pack.

Step 2 — Gather Electronic Components



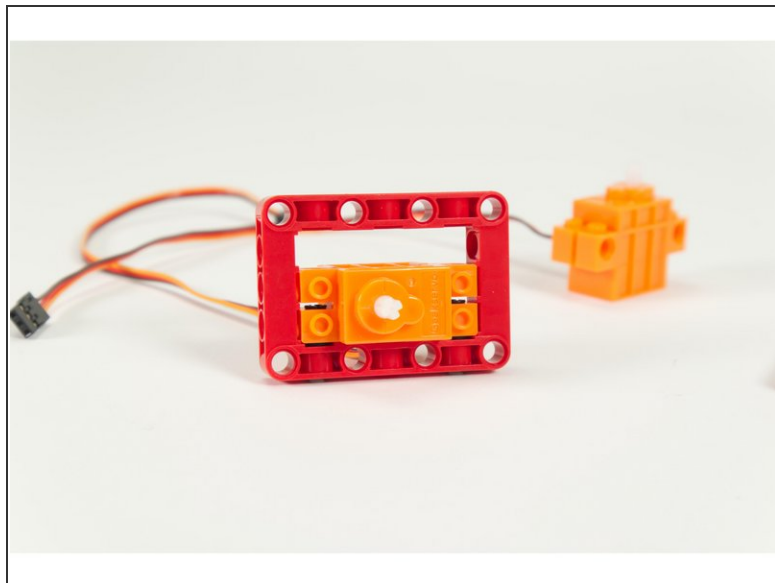
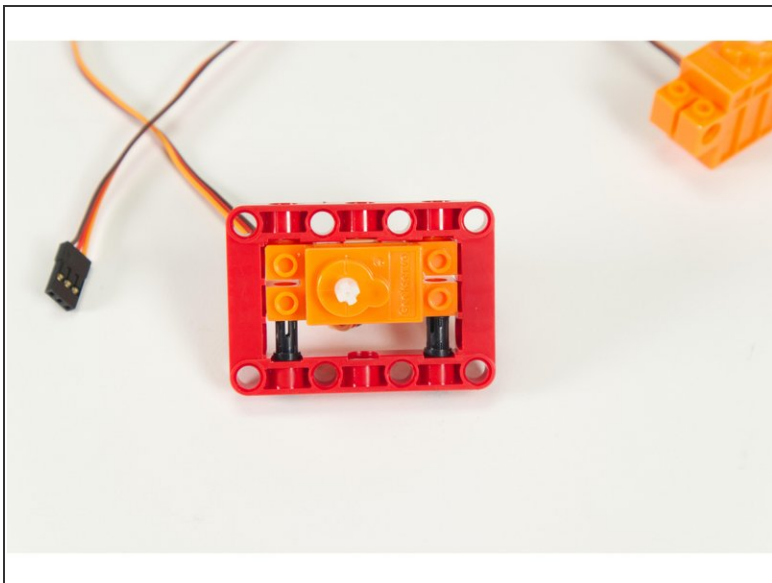
- You'll also need a Bit Board and micro:bit, along with two Brick Compatible Continuous Rotation 360 Degree Servos, and a Battery Pack.

Step 3 — Prepare Servos



- We'll start by attaching the servos to frame pieces using pins.
- Each assembly will need one servo, one frame, and two pins.
- Insert the pins on the inside of the frame as shown.

Step 4 — Attach Servos to Frames



- Slide the servo inside the frame and press it down onto the pins.

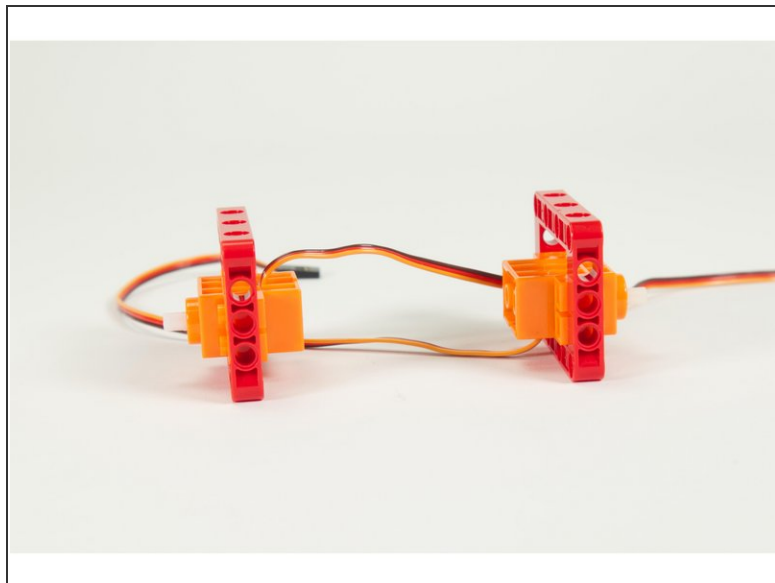
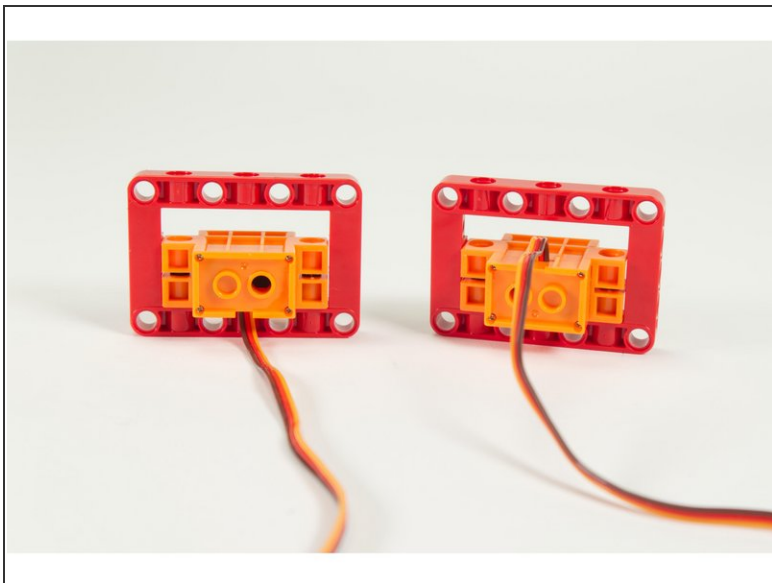
i Note: For the second servo you'll need to flip it over so the it mirrors the orientation of the first one.

Step 5 — Check Servo Orientation



- Your servos should look like this.
- Notice the placement of the shafts on each assembly.

Step 6 — Check Servo Alignment



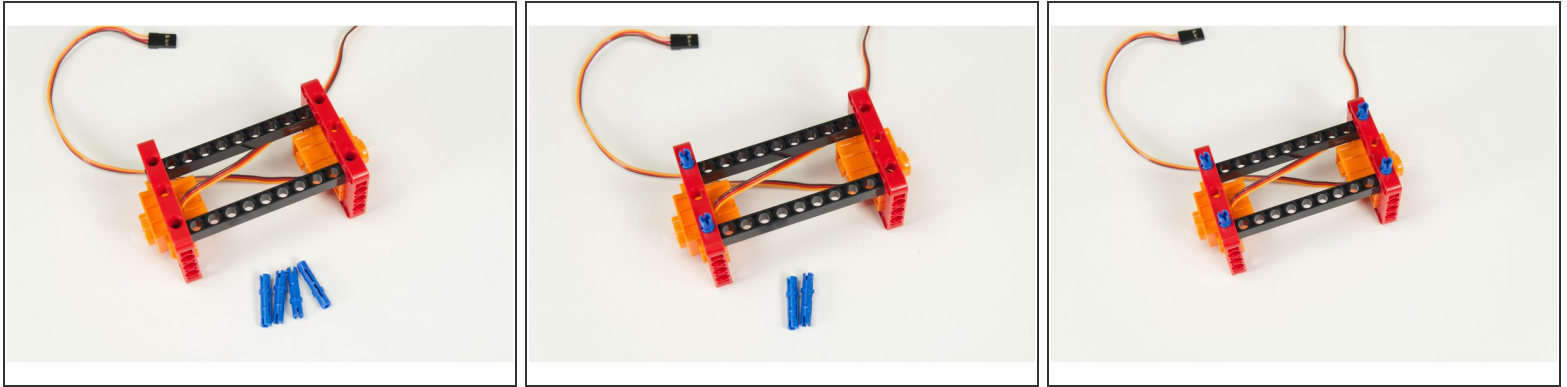
- If you turn them around to view from the back you'll notice how one set of wires is on top and one set is on the bottom.
- ❗ If they don't match this configuration make the needed changes before moving on.

Step 7 — Prepare Frame Stabilizers



- We'll use two long beams to connect the servos together into a frame, and then two L-shaped beams to stabilize the frame a bit more.

Step 8 — Add Stabilizer Beams



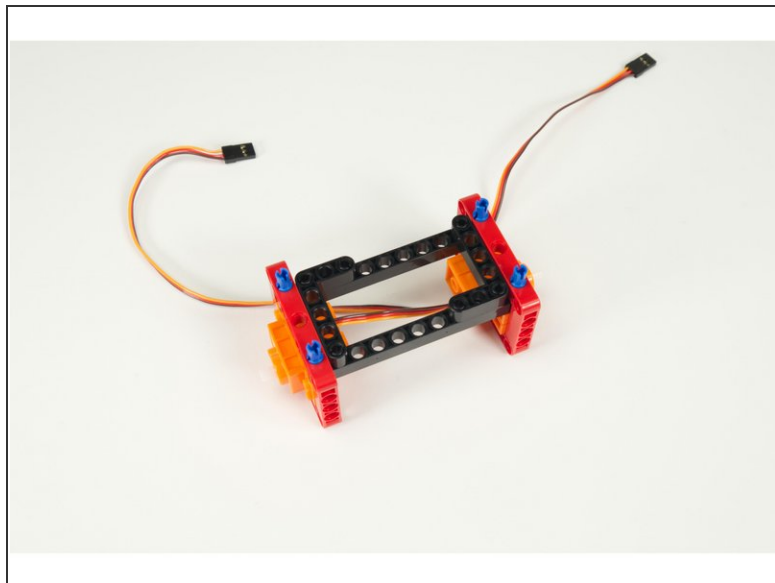
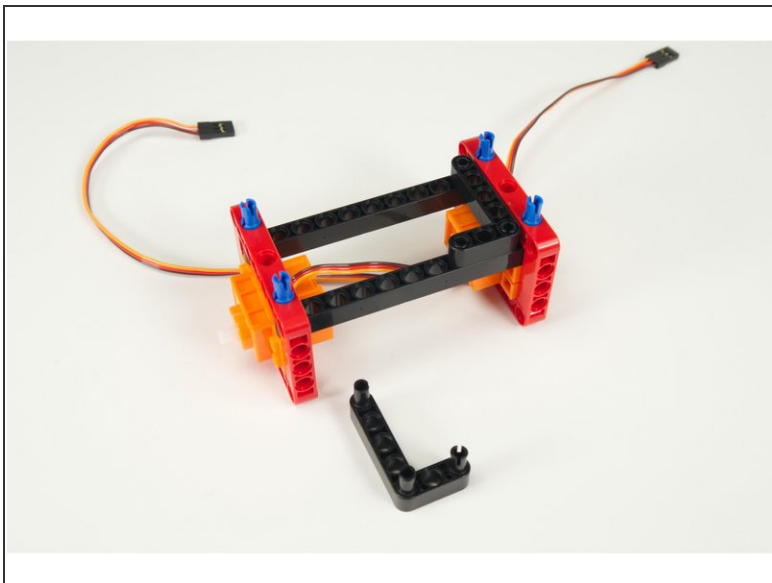
- Slide the long beams in place inside the frame on top of the servos.
- Use the long pins to hold the beams into place.
- Note: The long pins should go in 2/3rds of the way, so make sure you have the orientation correct. (1/3rd should stick out the top.)

Step 9 — Prepare L-Shaped Beams



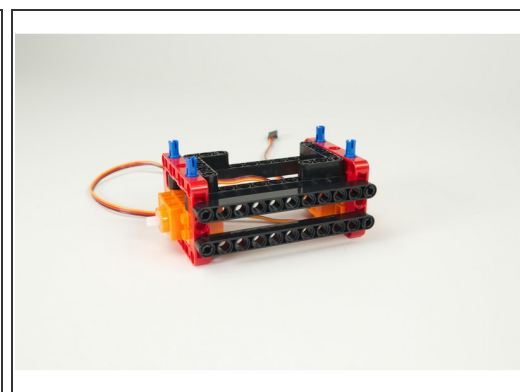
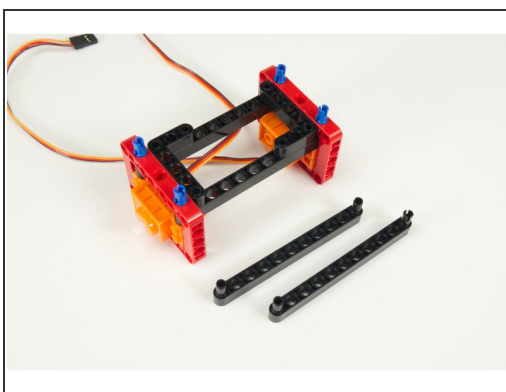
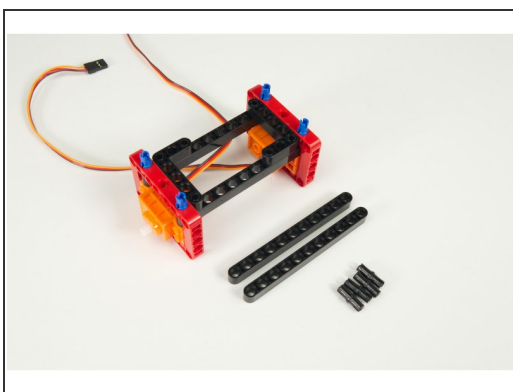
- Place pins at the ends and the corner of the two L-shaped beams as shown.

Step 10 — Add L-Shaped Beams



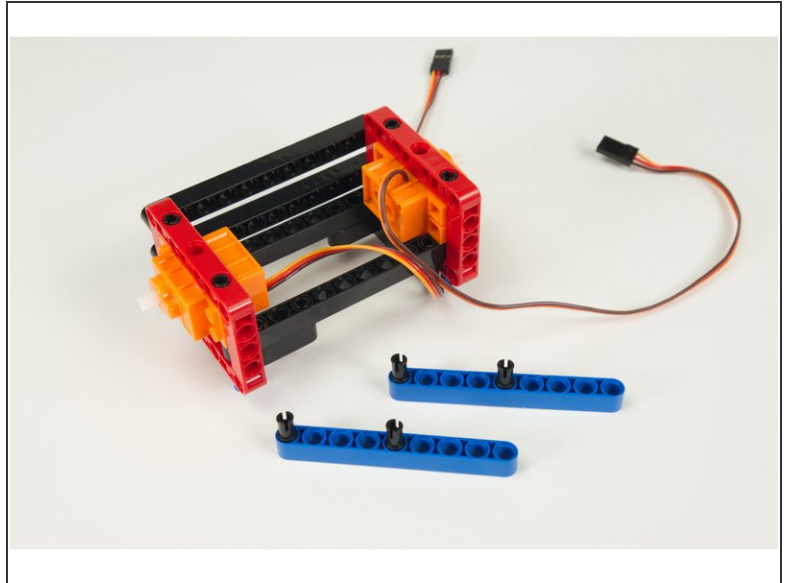
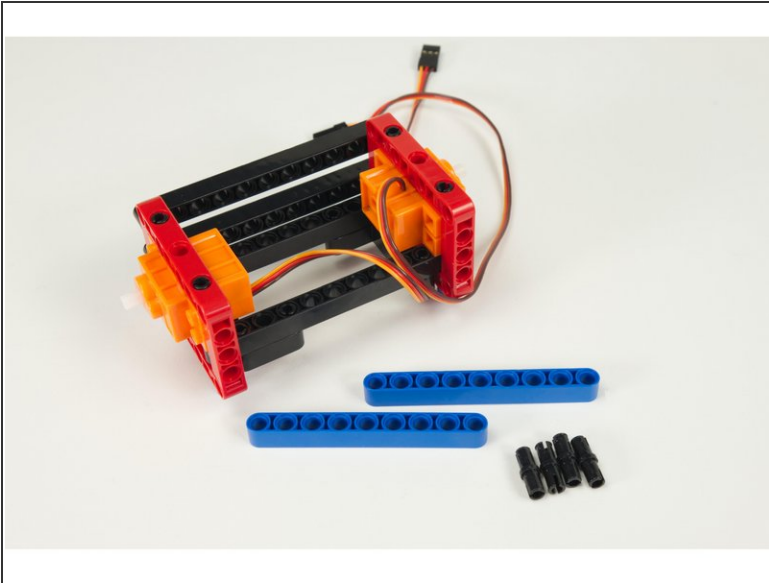
- Press the L-shaped beams into place.
- These will help keep the frame squared up so it doesn't wobble in the X & Y axes.

Step 11 — Attach Front Beams



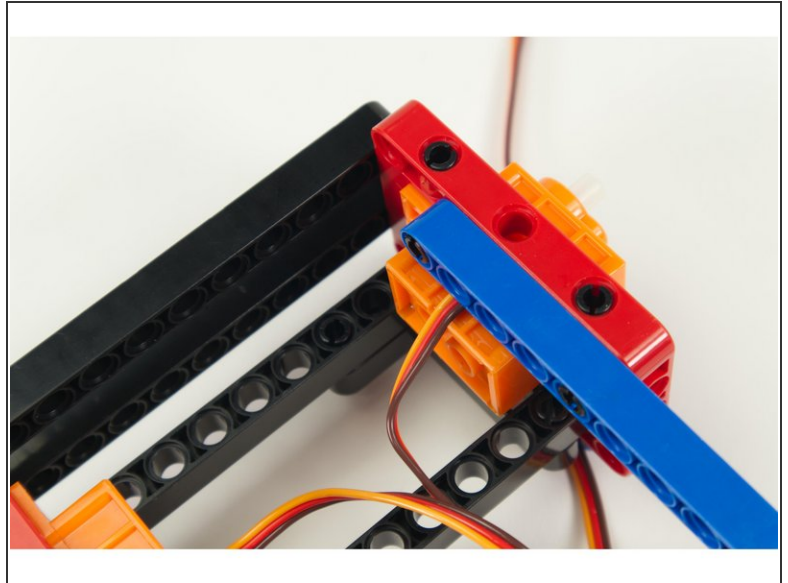
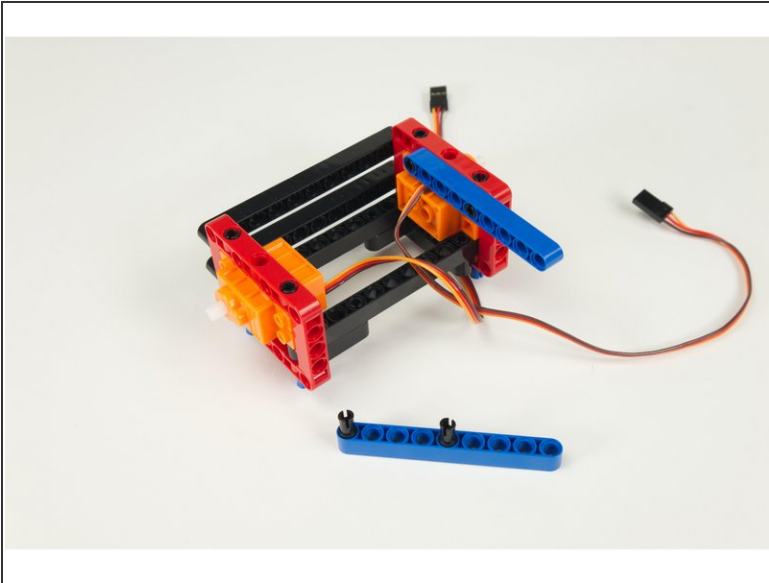
- We've got two more long beams to add. These will go on the front.
- Add two pins to each beam and attach them as shown.
- ⓘ These beams will be used as connection points later on when we add accessories to our rover.

Step 12 — Prepare Rear Stabilizer Beams



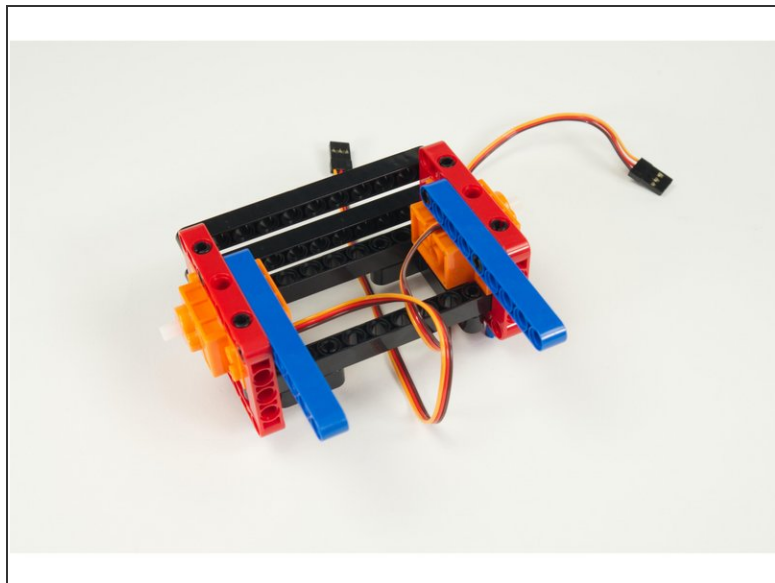
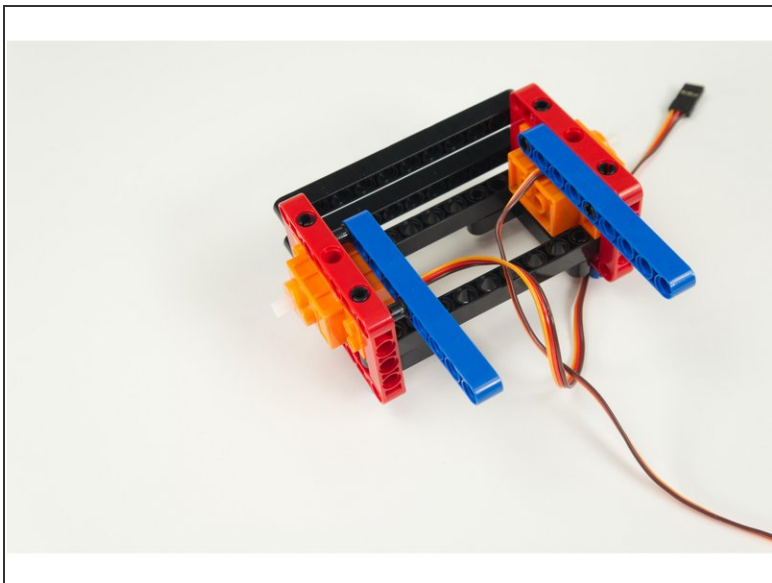
- Now that we've got the main frame assembled, and the front beams in place, let's turn the rover **around and upside down** to work on the back side.
- Place pins into the first and fifth holes of the two beams.

Step 13 — Add First Rear Stabilizer Beam



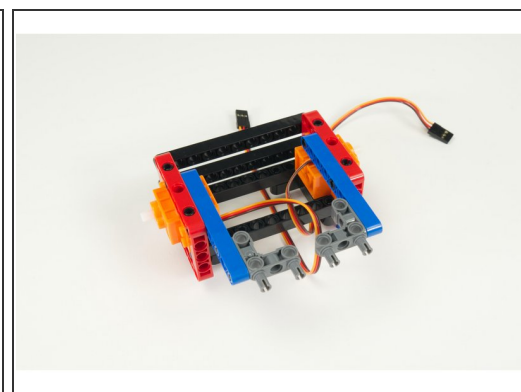
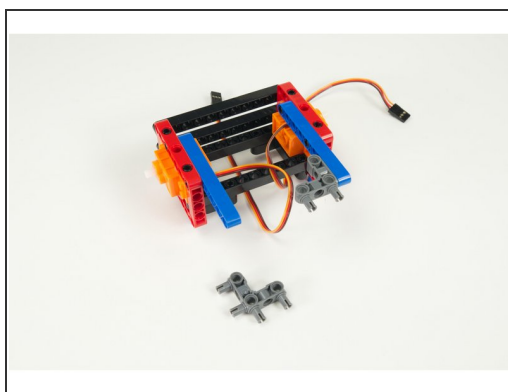
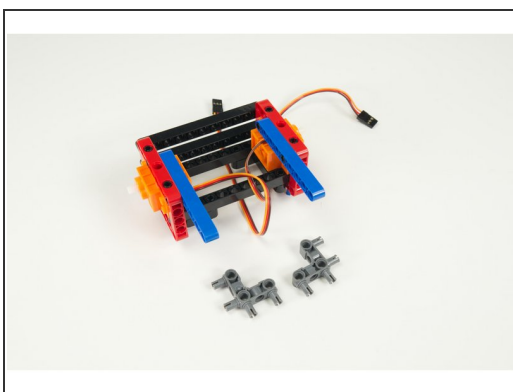
- Press one of the beams into place on the inside of the frame as shown.
- ☑ Remember, we're now working on the rover upside down. Don't worry, we'll flip it back to *right side* up soon.

Step 14 — Add Second Rear Stabilizer Beam



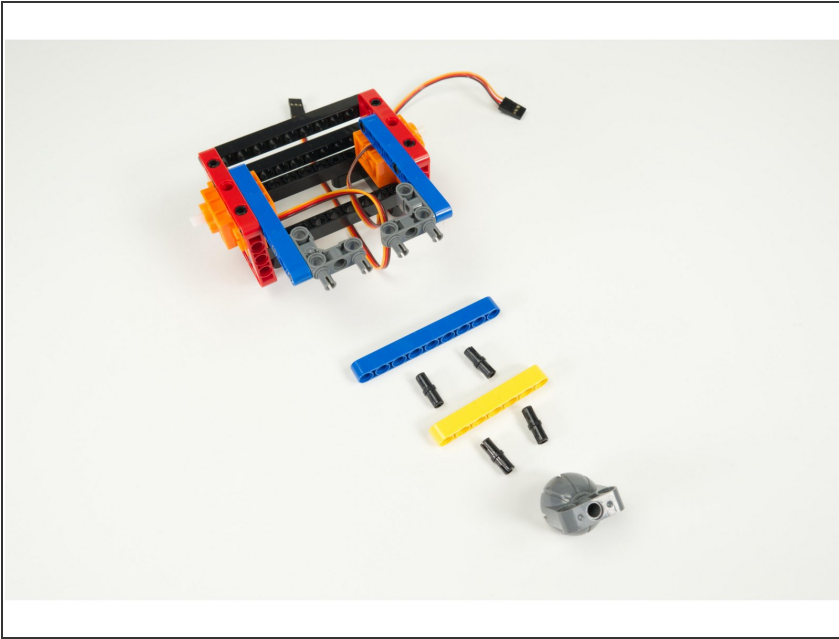
- Add the second beam, pressing it into place opposite the previously added beam.
- Once both beams are snapped securely into place we can move on to the next step!

Step 15 — Add 90 Degree Connectors



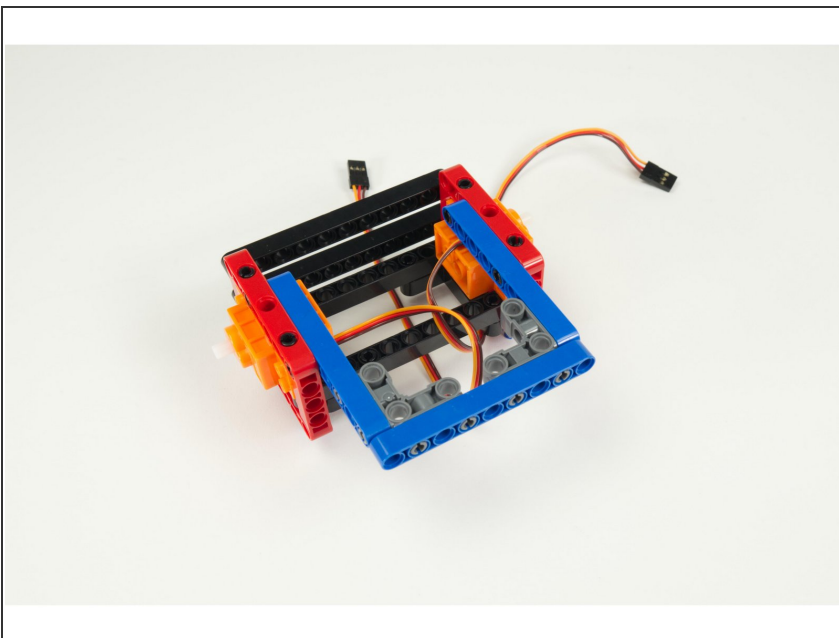
- Add the two 90 degree connectors to the rear stabilizer beams as shown so the pins are facing outwards.

Step 16 — Prepare Rear Caster Wheel Assembly



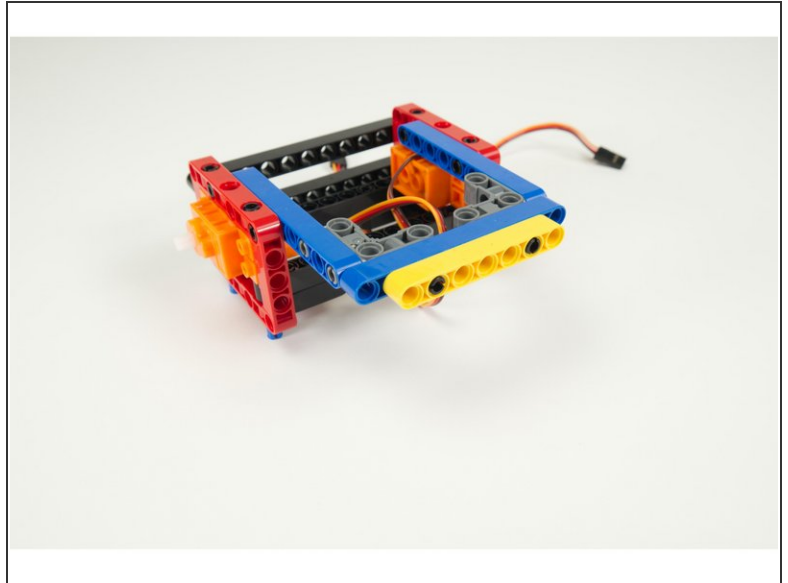
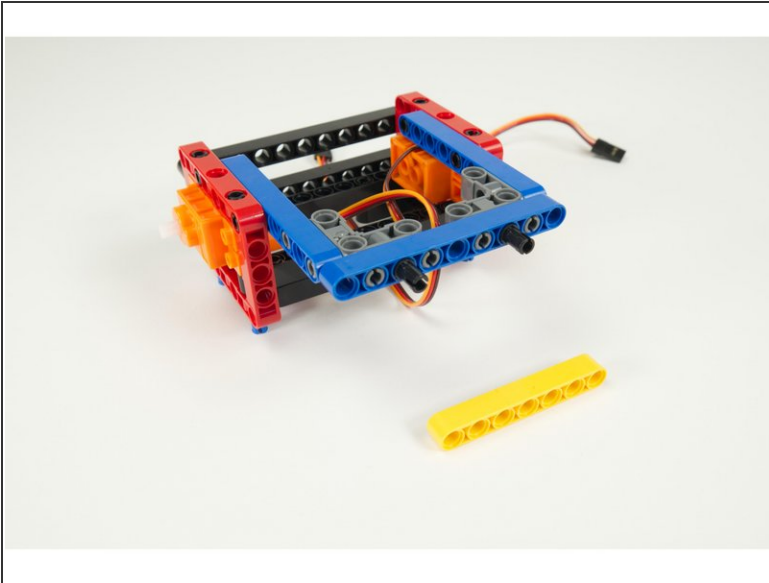
- There are two more beams to attach, each using two pins, and then we can add the caster wheel to the back of the rover.

Step 17 — Add Third Rear Stabilizer Beam



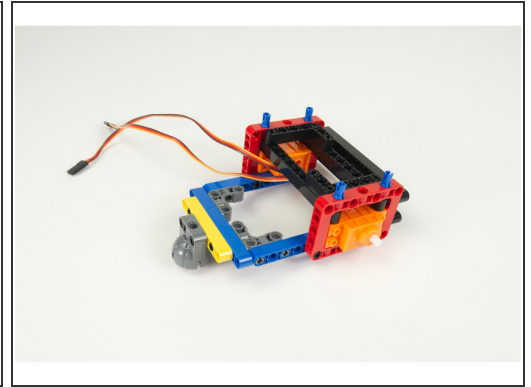
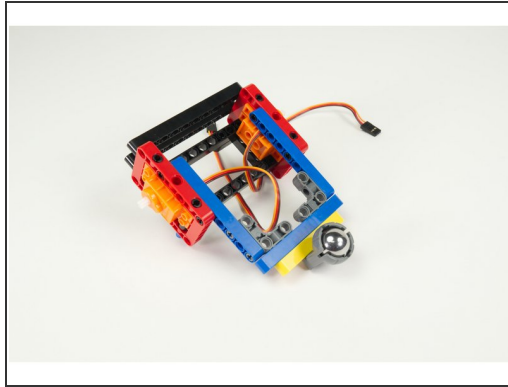
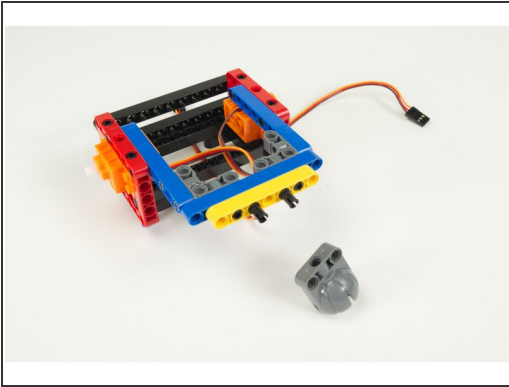
- Add the third beam to the 90 degree connectors by pressing it into place on the exposed pins.

Step 18 — Add Forth Rear Stabilizer Beam



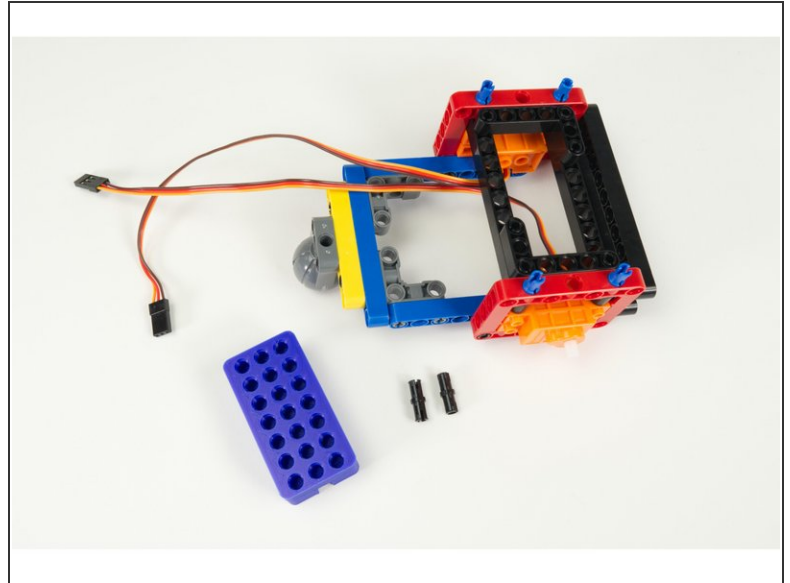
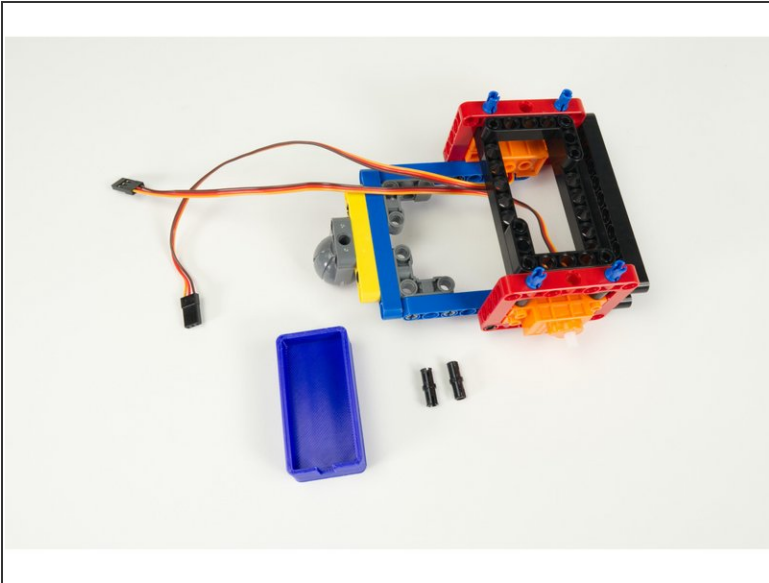
- Place two pins into the beam we just added, in the third hole from each end.
- After adding the pins you can attach the final rear beam.

Step 19 — Add Caster Wheel



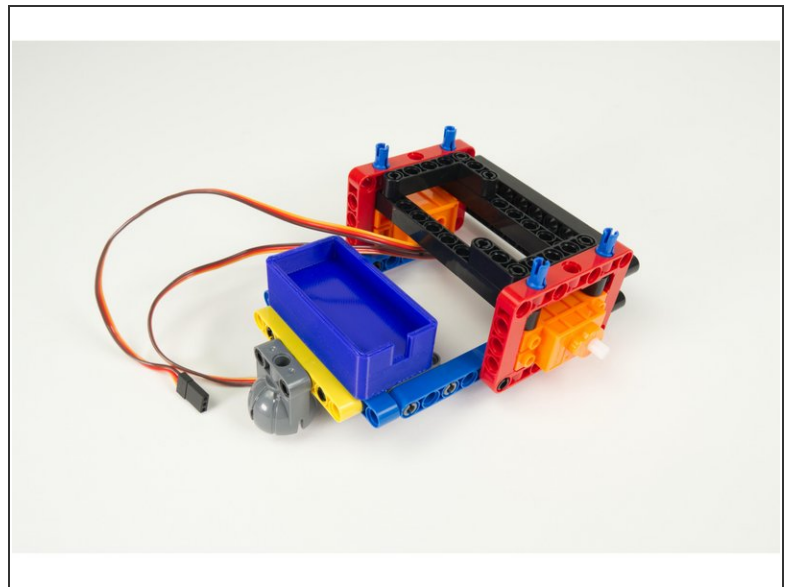
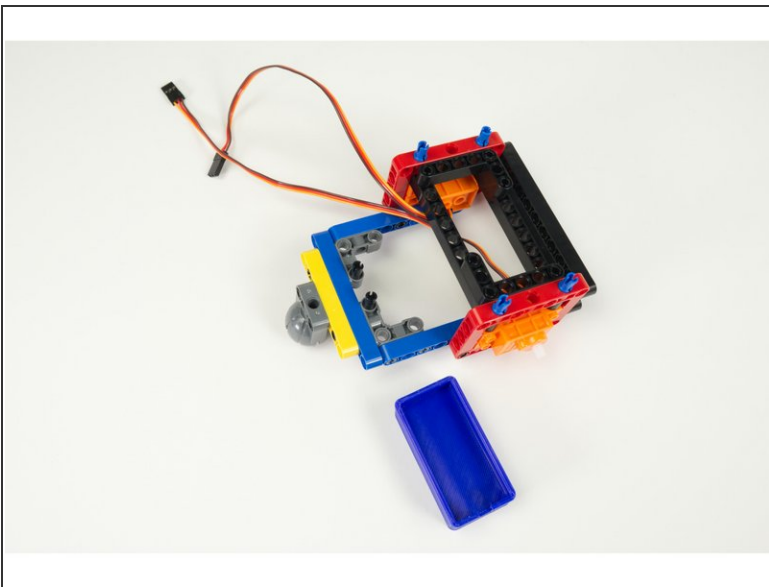
- Add two pins onto the shorter beam, in the third hole from each end.
- Press the caster wheel into place.
- ☑ Remember to add the caster wheel **upside down** since our rover is currently upside down.
- Once the wheel is attached the rover should tip down due to the weight of the steel ball.
- Now is a good time to flip the rover over so it's right side up.

Step 20 — Prepare Battery Holder



- Next up we'll add the battery holder. (This is the 3D printed part.)
- You'll need two pins to attach the battery holder.

Step 21 — Add Battery Holder



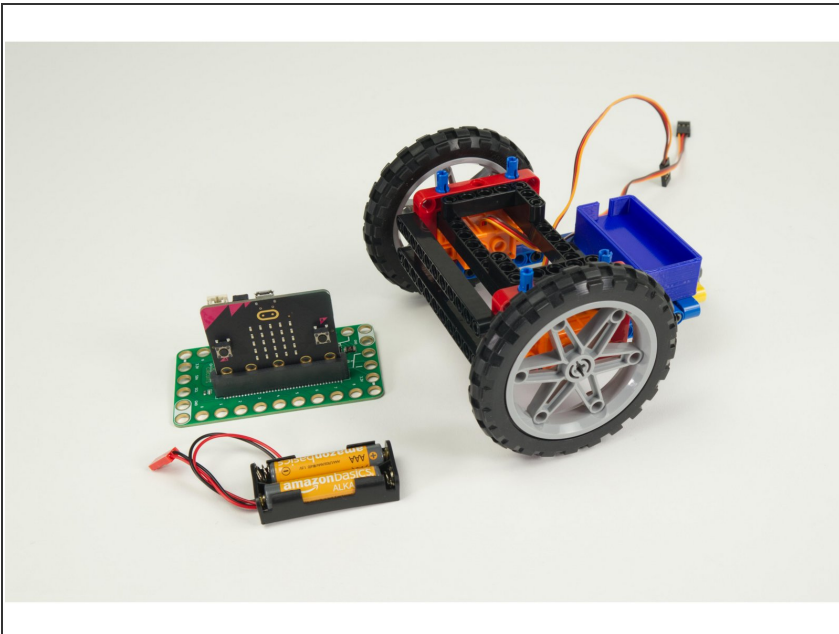
- Place two pins into the 90 degree connectors, facing upwards.
- Add the battery holder by pressing it down onto the pins as shown.

Step 22 — Add Wheels



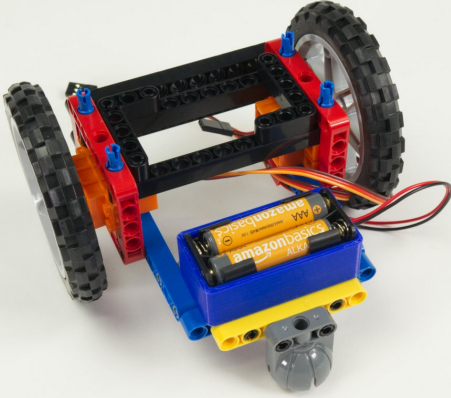
- Our rover still doesn't look very Rover-ish... because it needs wheels!
- You can add the wheels now. They just press fit onto the servo shafts.
- Now it's looking more like a rover.

Step 23 — Prepare Electronics



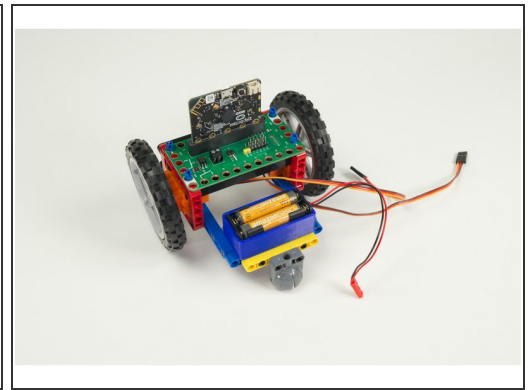
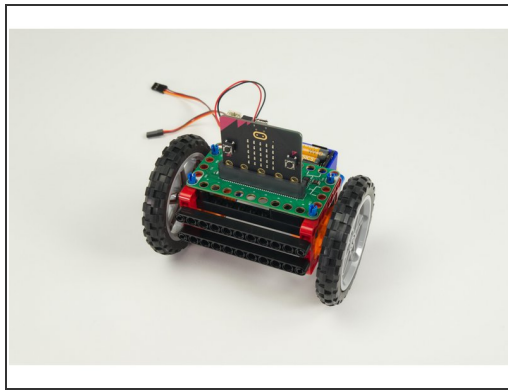
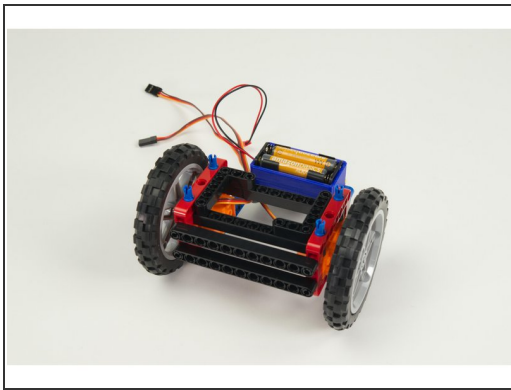
- Now that we've got the rover built we can add in the electronics to make it go.
- If you haven't already, place the micro:bit into the Bit Board (in the proper orientation) and grab a Battery Pack.

Step 24 — Add Battery Pack



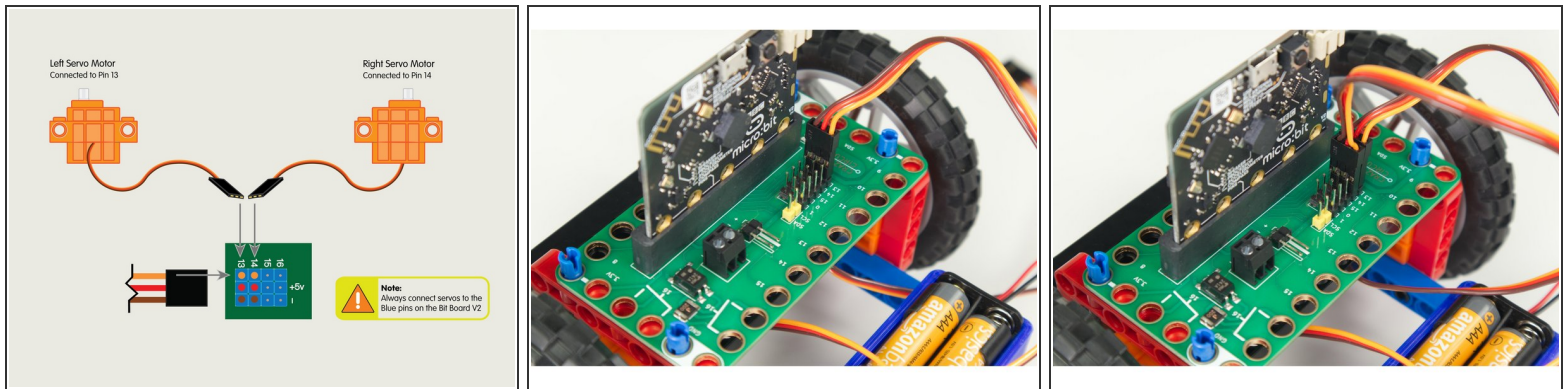
- We'll start with the battery pack. It fits into the 3D printed battery pack holder we added to the back of the rover.
- Note the slot on one side of the battery pack holder where the wires go.

Step 25 — Add Bit Board



- With the battery pack in place let's turn the rover around to the front so we can add the Bit Board.
- We've already got four pins sticking out of the top that we added in Step 8. The Bit Board will fit right onto those pins.
- Make sure the front of the Bit Board (and front of the micro:bit) are facing forward on the rover.
- Once the Bit Board is in place we can turn it around to the back so we can plug things in.

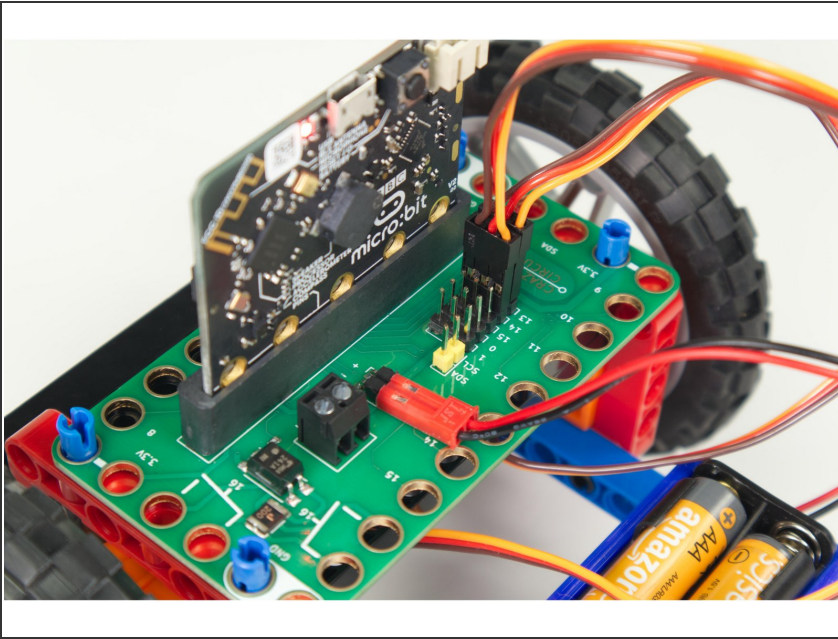
Step 26 — Connect Servos



Note: Please refer to the illustration of the servo connections showing the Blue Pins on the Bit Board V2.

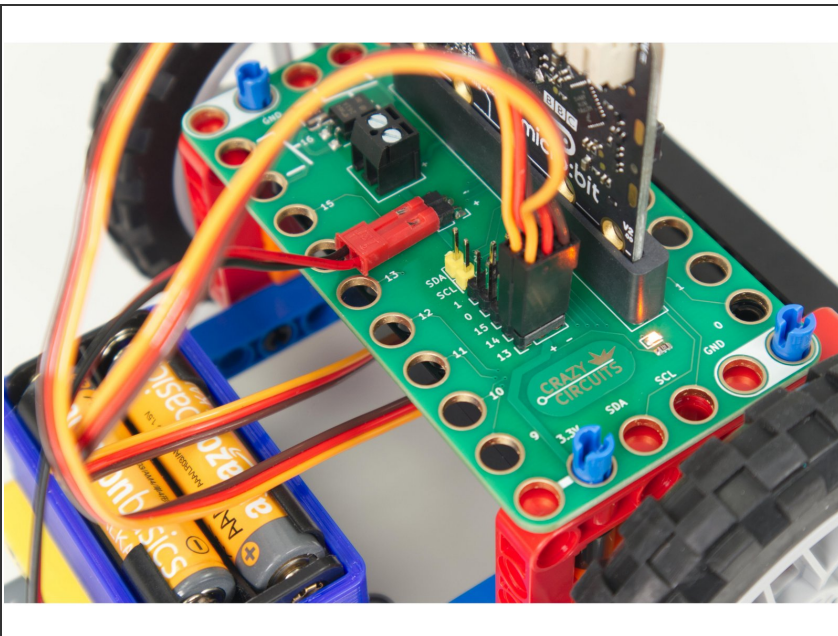
- i** The photos were taken with a Bit Board V1 during development and it lacks the Blue Pins. (We are in the process of updating the photos.)
- Plug the left servo connector into the row for **Pin 13**. The **orange** wire should go to the pin closest to the **13** on the board, the **red** wire goes into the **+5v** row, and the **brown** wire goes into the **-** row, which is ground.
- Plug the right servo into the row for **Pin 14**, matching the orientation of the servo connector for the left servo.
- i** Make note of **Pin 15**. We're not connecting anything to it now, but other guides will use **Pin 15** to connect a third servo for additional accessories.

Step 27 — Connect Battery Pack



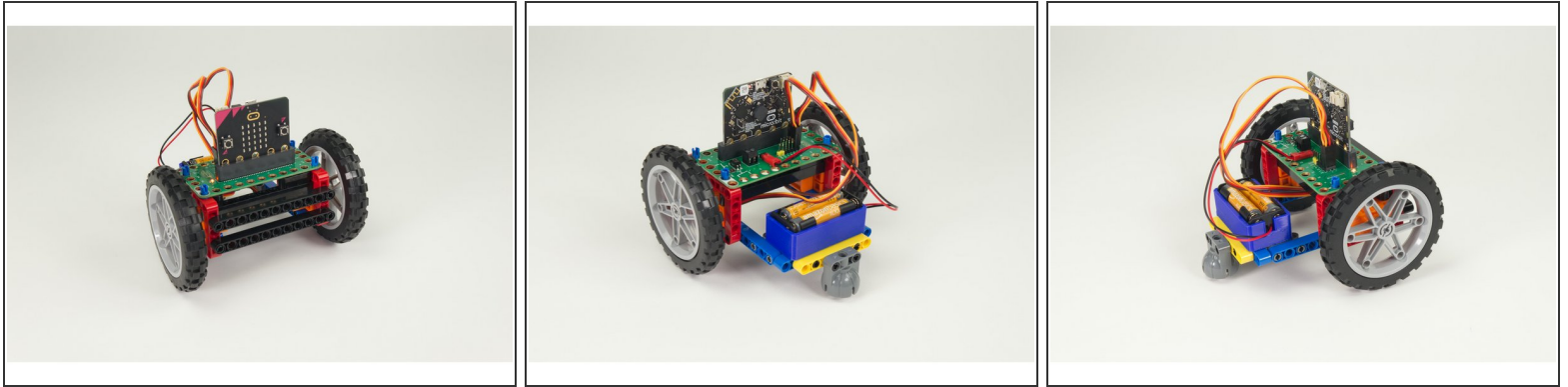
- The last connection is the battery pack. It connects to the Bit Board as shown to provide power to the micro:bit and the servos so your rover can move.
- ❗ We recommend a fresh set of Alkaline batteries (not rechargeable) for maximum performance.

Step 28 — Check Wiring



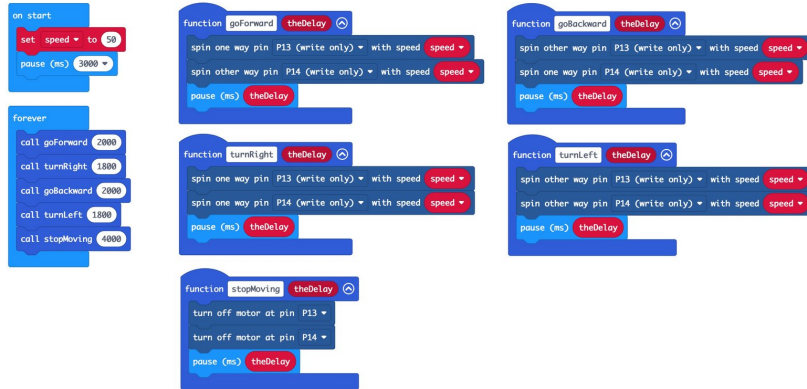
- Take a moment to double check your wiring.
- Are the servo connector oriented the right way? Hint: Make note of where the **orange wire** is.
- Is the battery pack plugged in properly? The **red wire** should align with the **+** symbol behind the connector pins.
- If everything looks good, keep going!

Step 29 — Admire Rover!



- You've just built the Rover! Take a second to admire your work.
- The great thing about this rover is that it's easy to modify it, to add or remove parts, and experiment.
 - For instance, you could replace the castor wheel with a [Pen Holder](#) so the rover can draw while it rolls.
 - We've added another guide for a [Rover Gripper](#) you can attach and control, as well as a lifter to lift objects.
 - We've got a distance sensor we can add to the front to make the rover avoid running into things.
 - You can add two sensors to make a line following robot.
- But first... Let's add some code so the rover can move.

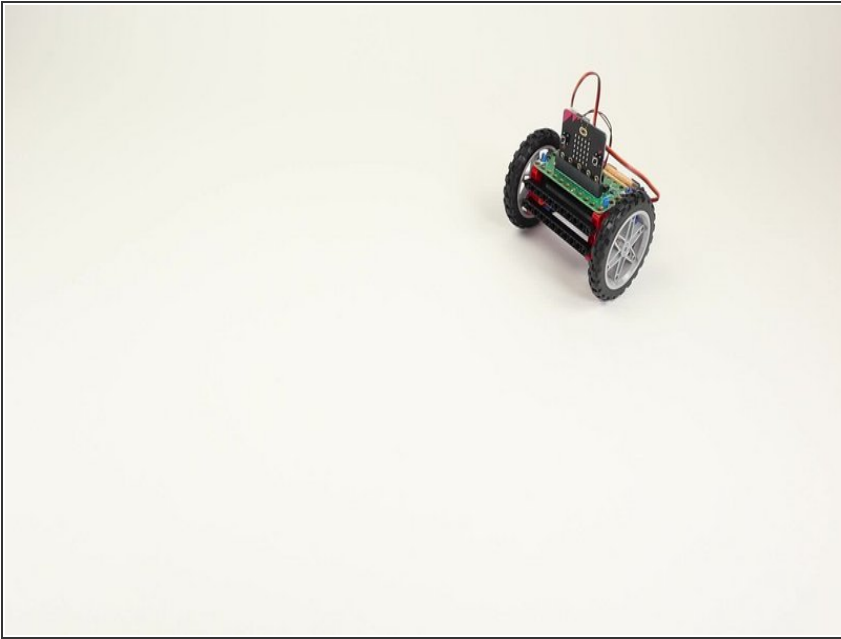
Step 30 — Load the Code



⚠ If you've never used a micro:bit before you'll want to check out this guide: [Bit Board V1 Setup and Use](#)

- We're going to load the following code for our **Rover Test Code** program:
https://makecode.microbit.org/_euKUdXXKq...
- This test code is very simple. Be aware that your rover will start moving three seconds after the code is loaded, so be ready for that!
- If you want to change that just edit the **pause** block in the **on start** section. (Note: 3000 milliseconds equals 3 seconds.)
- Another trick is to just pop the wheels off when you upload the code. :)

Step 31 — Test it Out!



- With the code uploaded you should be ready to test it out!
- Use a large flat surface. The floor will work well, or a table - just be ready to catch the rover if it gets too close to the edge!
- Plug the battery into the Bit Board, wait three seconds, and your rover should move.
- If your rover moved properly (forward, turn right, backward, turn left, stop) then all is well and you're ready to extend your Rover by adding accessories, remote control, and other capabilities.