

Guide for Modified Assembly: Lightning McQueen

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*A 2 in. length of 1 in. PVC is placed vertically here to connect the two 90° elbows

Tools Required:

PVC Cutter Wire Strippers Power Drill Wire Caps

Part	Description [Quantity]	Cost
	1 in. PVC (13 ¾ [x2], 11 [x1], & *2 [x2] in.)	\$3
	¾ in. PVC (10 [x2] & 5 [x1] in.)	\$3
	1 in. PVC, 90° elbow [x4]	\$3
	¾ in. PVC, 90° elbow [x2]	\$3
	PVC T-snap [x2] & adapter [x2]	\$8
	Toggle on/off switch [x1]	\$5
	¾ in. x 2 in. carriage bolts [x6] and nuts [x6]	\$3
	Industrial Velcro (24 in.)	\$10
	Main Activation Button	\$50

Materials and Tools:

- PVC
 - o 40 inches of 1 in diameter PVC
 - o 25 inches of ¾ in PVC
 - o 4 x 1 in elbows
 - o 2 x ¾ in elbows
 - o 2 x 1 in snap-on T's with ½ in threaded hole
 - o 2 x ½ in to ¾ in threaded adapters
- 4 x 2 ½ in bolts
- 2 x 2 in. bolts
- 6 ¾ in nuts
- 2 wire nuts
- Wire Cutters
- Phillips head screwdriver
- PVC Cutters
- Scissors
- 1.5 ft industrial Velcro
- Tape measure

- Power Drill, ½" and ¼" drill bits
- SPST Toggle Switch with screws on leads

Procedure

Safety

Please wear safety glasses, and wear gloves for removing plastic burrs

When stripping wire, make sure to cut only through the plastic tubing and not the wire itself. Also, make sure to strip only enough wire so that you do not leave wire exposed when connecting wires together. Cutting too deep into the wire or leaving unprotected wire may cause sparks, short circuits, and overheating. Always use wire strippers and not scissors.

Before Modifying

Unpack the Lightning McQueen. It is essential that all parts of the kit are preserved during the modification process.

Before working with the wires, unplug the internal battery. The battery is found when the seat is removed, and it may be unplugged by separating the black plug attached to it from the one found in the car.

Cut the 1" PVC to the following lengths:

- 2 x 14 in.
- 1 x 11 in.
- 2 x 2 in.

Cut the ¾ inch PVC to the following lengths:

- 2 x 10 in.
- 1 x 5 in.

Electrical Modifications

On the Big Red Button, cut the black wire towards the very bottom, near the end that looks like an AUX cable or headphone adapter. That portion is not needed for the rest of the assembly.



Separate the two black wires so that you have two individual wires for about 8 inches.

Strip about a ½ inch of each wire segment using the wire cutters. Make sure that the only part stripped is the plastic and not the wire. Stripping the wire and making it thinner could cause overheating when electricity is run through the car. Twist each end clockwise.

Unscrew the top and bottom parts of steering wheel by unscrewing the steering wheel from the bottom. There should be four screws.

Remove the face plate and speaker box. This is the removable portion in the center of the frame. You no longer need this piece. Also unplug the preexisting activation button from the white plug it is connected to. Cut off the plug inside the car as close to the plug as possible.

Remove the seat from the car (this should already be unscrewed from when you removed the battery) and remove the strip of red plastic running through the center of floor of the car (by removing the screw at the end near the seat and prying it open) to expose the wires and cavity underneath. Using a screwdriver, unscrew the steering column near where a child's knees would be in the car. There should be two screws.

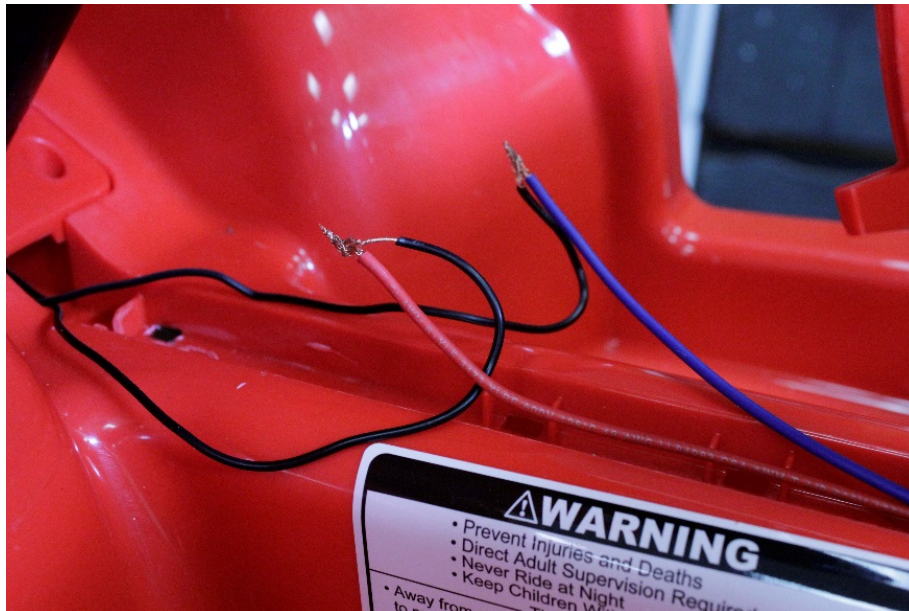
Pull on the red and blue wires that run through this area until the whole length of the wire is outside of the steering column.

Feed the black wires from the Big Red button through both the top and bottom portions of the steering wheel and down the steering column. From the bottom of the steering column, pull the black wires from the button down and out of the steering column (you may have to use pliers).

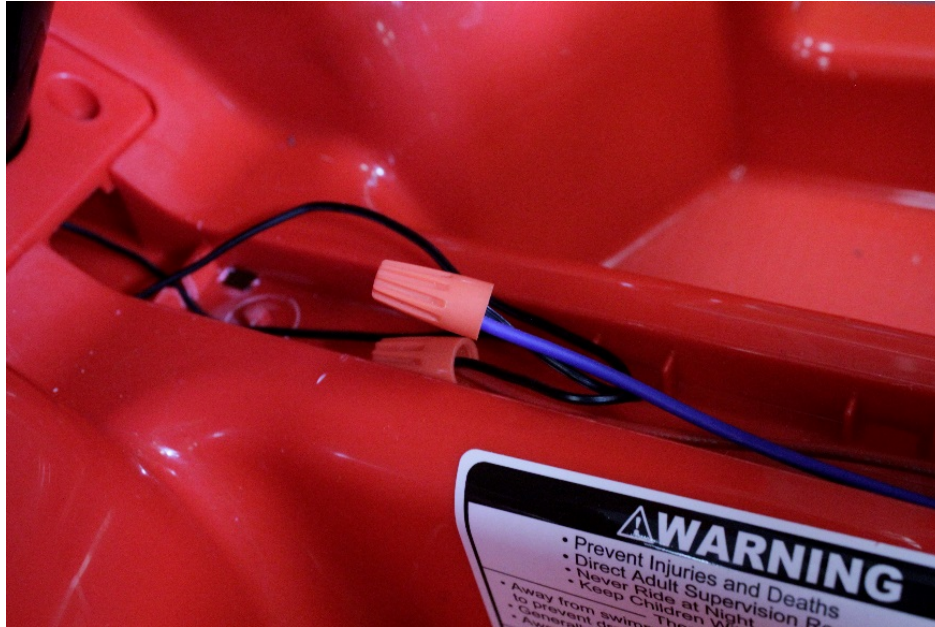


Strip the red and blue wires the same way we stripped the black wires: strip about ½ inch, and make sure not to strip the metal portion.

Twist the stripped metal portion of one black wire to the red wire, and the stripped metal portion of the other black wire to the blue wire. Make sure you twist clockwise.



Twist a wire nut to each of these ends. Make sure this is twisted clockwise as well and that the wire cup fits snugly on the wires. Use of a wire cap too big or too small risks the cap falling off or breaking the connection. Wrap the bottom of the wire cap and the wires with electrical tape using a figure eight pattern.



Force the wires down into the cavity and put the strip of plastic back in. Put the screws back in the steering column and reassemble the steering wheel.



Cut two 6 inch pieces of Velcro. Peel the plastic off to expose the adhesive. Place one side on the bottom of the red button, and one end on the top face plate of the steering wheel. It is essential that these two side line up when the button in place on the steering wheel, which should be centered as well.

Now, were going to work on the toggle switch, which is what turns the car on and off.

Cut the red wire (connecting the motor to the black wire) 6" to 7" from the motor and strip both ends. Twist both ends clockwise.

Using a drill and a ½ inch drill bit, drill a hole through the back. The hole should be centered from left to right and from top to bottom of the back bumper. Make sure to be careful when drilling through the second layer, on the other side is the motor.

Remove the ring and on-off brace that are screwed onto the toggle switch. Orient the switch so on and off goes up and down, not left to right.

Feed the red wires from the motor through the innermost hole you just drilled. Unscrew the screw on the top metal lead of the toggle switch, but not too much that it comes out. Mold the end of one of the wires into a hook, wrap it around the screw, and tighten the screw back in so that the wire is held in place. Repeat with the other wire and the bottom metal lead. Make sure the wires is well connected and that the wire is not separated.

From the inside of the outermost hole you drilled, push the switch through. On the outside, screw the ring and on-off brace back on.



Before proceeding, test if the Big Red activation switch and the toggle switch work. To do this, plug the battery back into the car while the toggle switch is off. Press the Big Red button and make sure the car does not activate. Flip the toggle switch, and again press the Big Red button. The car should now activate. Make sure to unplug the battery before proceeding.

Body Support Modifications

Situate the 14" segment of 1" PVC with one end in the top left corner of the windshield and the other end above the left rear wheel like in the picture below.

On the front, drill about a half inch from the end. Go through the PVC and car material. Place a 2 ½ inch bolt through the holes, and place a nut on the end through the interior of the car.

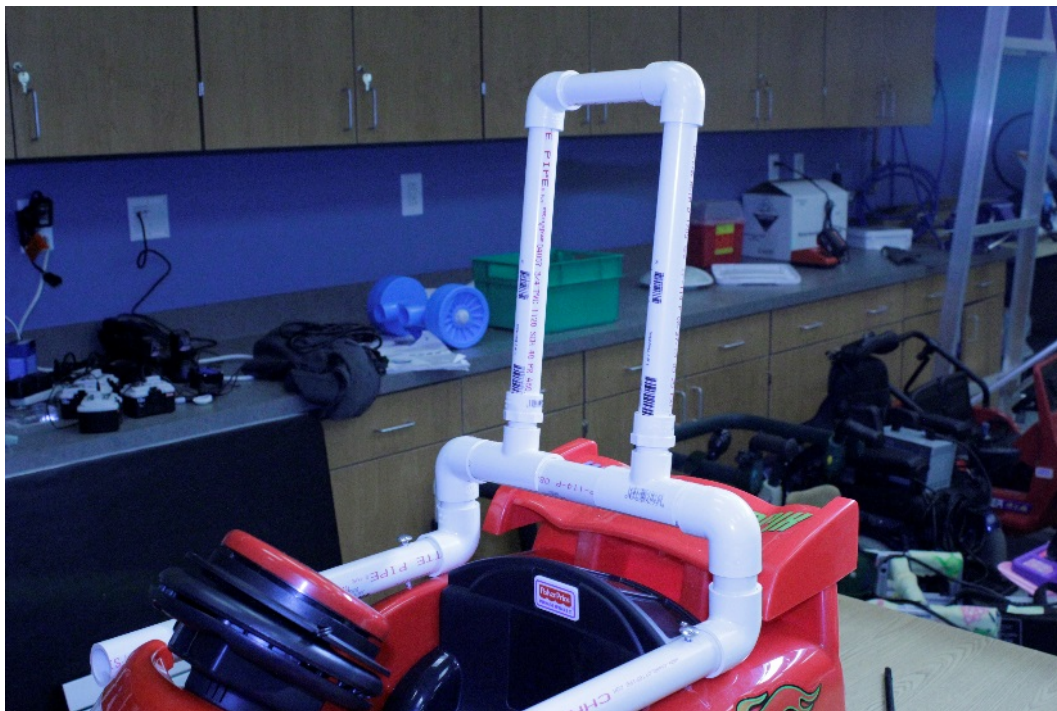
On the back, drill about an inch from the end. Go through the top of the PVC and through the car material. Place a 2 ½ inch bolt through the holes and a nut on the end. Repeat on the other side.



On the back of both sides, attach a 1" PVC elbow. Insert the 2" pieces of 1" PVC into the other end of the elbow. Attach another two 1" PVC elbows so that they face toward the middle of the car. Insert the 11" piece of 1" PVC into these elbows.



Attach the snap-on T's to the 11" bar, and push them as far out towards the ends of the PVC as possible. Screw in a threaded $\frac{3}{4}$ " adapter into each snap-on T, and insert a 10" piece of $\frac{3}{4}$ " PVC into each.



Place a $\frac{3}{4}$ " elbow on each top so the ends face each other. Insert the 5" piece of $\frac{3}{4}$ " PVC to complete the PVC support structure.

Separate 1 ft of the Velcro into its respective sides, but do not remove the plastic covering the adhesive. Cut a hole in one end of each piece. This is going to be the seatbelt. Drill a hole in the corners of the top of the seat like the picture below. Insert a bolt through the hole of the adhesive side of the soft half of the Velcro and a bolt through the hole of the spiky side of the spiky half of the Velcro. Insert these bolts into the holes in the car on each side. Place a nut on the end of each one to secure them.





CONGRATULATIONS! You've successfully modified your very own McQueen car.