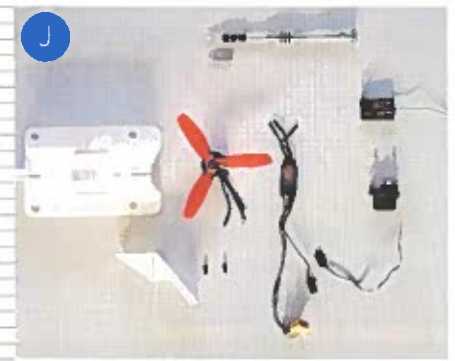
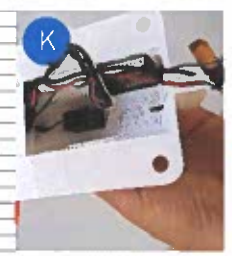
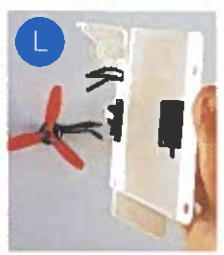
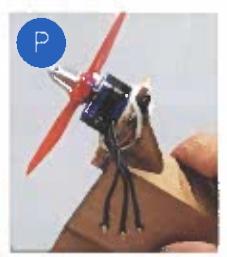
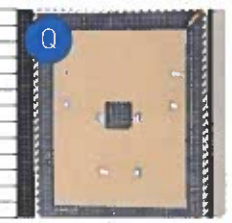
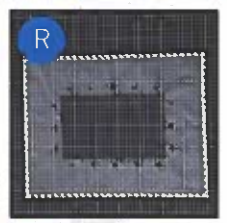


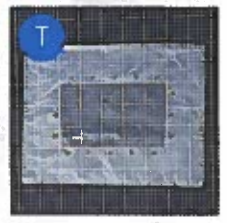


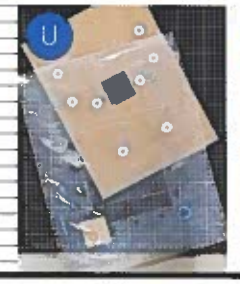


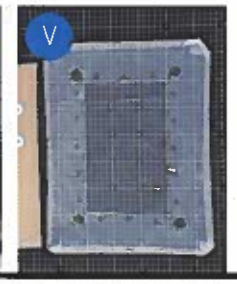












pieces: the servo goes in the *motor mount*, and the brushless motor goes in the *motor pod* (Figure J). Modify the mounting holes if necessary to fit your motors.

Mount the servo and then connect it to the corresponding channel on the receiver. Put the receiver and electronic speed control (ESC) into the motor pod and secure with double-sided tape. Make sure there's room for the battery (Figure K).

Thread the cables from the ESC through the hole in the motor pod one at a time.

Attach the motor mount to the pod, and secure with Strawbees (Figure L).

Mount the brushless motor using its mounting screws or another system depending on what kind of motor you find (Figure M). Skip to Step 5.

4. CARDBOARD MOTOR POD

If you don't have access to a 3D printer, you can easily make this cardboard version.

Print, trace, and cut out the motor pod template in cardboard. Gently cut and pre-fold all the creases (Figure N).

Glue the pod together where indicated on the template (Figure O). Make sure to strengthen the mounting surface for the motor and secure it with epoxy or a glue gun.

For your brushless motor, cut out a cardboard mounting plate and add some plastic or wood to make it stronger. We used a milled wooden piece for this tutorial. Improvise to suit your motor setup. Just make it strong enough to hold your motor and make it easy to zip-tie into place.

Attach the motor to your mounting plate. We used screws but this depends on your setup. Some motors have a motor mount included. Then zip-tie the motor mount in place on the pod (Figure P).

5. MAKE THE SKIRT

Cut off the sealed edge of the trash bag and one of the folded edges, and open the bag so you're working with a single layer of plastic.

Place the hovercraft base on top of the plastic. Trace an offset outline of your base, about 4cm–5cm to the outer edge. This can be varied for different lift heights above the ground, varying the hovercraft's ability to cross obstructions but also its stability. Experiment as you see fit.

Place double-sided tape all along the outline of the edge. Cut the plastic at the outer edge of the tape (Figure Q).

Cut out an offset square in the center of the sheet, about 8cm from the outer edge. This also defines the lift height of the hovercraft.

Now you'll make the holes that let air out under the hovercraft. All around the center hole, mark the air holes about 1.5cm away from the edge of the inner square and 5cm between neighboring holes. Cut out each air hole about 1cm in diameter (Figure R). You can do many experiments with size and placement of these holes.

Peel the protective backing from the double-sided tape and then lay an additional plastic sheet on top of the bottom plastic sheet. Align it right along two edges to reduce waste (Figure S). Have a friend help out so it doesn't get stuck in the wrong position. Then press down with your hands and smooth out any creases.

Cut off the excess plastic along the outside of the double-sided tape (Figure T).

Mark 4 large holes on the top sheet approximately 3cm in diameter, inside the cardboard perimeter but outside the small holes (Figure U). Cut them out, making sure only to cut through the top layer of plastic. This is where the air from the motor pod is let into the skirt. The small holes are in the bottom sheet.

Turn the skirt inside out so the taped crease is on the inside of the skirt (Figure V).

Put double-sided tape along the outline of the bottom of the base. Center the cardboard base over the skirt and then press it down (Figure W).

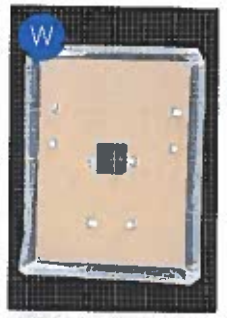
6. MAKE THE STEERING FIN

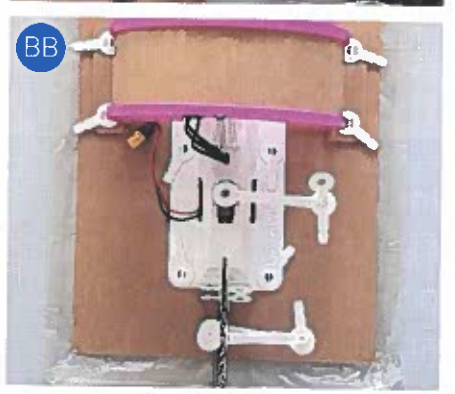
Trace any of the fin templates on cardboard. Gently score the crease and bend it back and forth a couple of times so the fin can move easily.

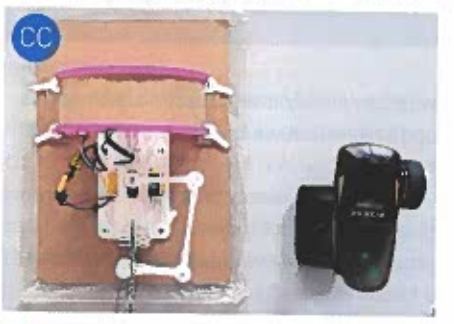
Use a pencil to punch the holes for fixing the fin to the motor pod and the linkage. We cut the short fin model for a faster-turning, but harder-to-control hovercraft. The fin is really easy to experiment with, as it is only connected to the pod linkage with two Strawbees.

Use 4 Strawbees to make two cardboard connectors for the linkage, as shown in Figure X.

Attach the Strawbees cardboard connectors by pushing the leg side through and locking the legs with two more Strawbees on the other side of the cardboard. Squeeze the locking Strawbees







Erik Thorstensson

up against the cardboard so they sit tight and secure (Figure Y).

7. ASSEMBLY

Now you have all the pieces you need. It's time to assemble your hovercraft.

CAUTION: The propeller moves very fast and could hurt you. Keep the battery disconnected until the hovercraft is ready to test, to prevent the motor from spinning.

Slide the motor pod onto the four connectors around the hole, then attach the propeller guard to its four connectors. Secure both with Strawbees from the top. Slide the Strawbees all the way down until everything sits tight against the cardboard base.

Put a Strawbee over the servo arm and secure it to the servo horn with a piece of drinking straw cut to about 5cm long (Figure Z).

Attach another straw to the top connector on the fin. Cut this one a bit shorter than the straw on the servo; we cut it to 3cm but you can experiment with the ratio to achieve the right amount of throw for your fin.

Then cut a straw to form a triangle from the bottom of the fin (Figure AA).

Put Strawbees in the three open ends of the straws. Then make linkage connections as shown (Figure BB). Leave the final linkage open until you power up the system.

Leave one motor cable disconnected from the ESC. Grab your R/C transmitter and make sure all trims are neutral, then connect the battery to power up the hovercraft. Secure your servo horn at 90° from the motor pod, check that your movement is correct, and reverse if necessary. Then cut the final straw linkage so that the fin lines up perfectly straight with the hovercraft (Figure CC).

Unplug the battery, then connect the cables to the motor. Your hovercraft is done.

USE IT

» Setup and Racing

Now follow the instructions that came with your speed controller to set up your R/C system. After that, you're all set to race!

Your hovercraft is cheap, fast, and surprisingly robust, able to survive multiple crashes at speeds up to 25mph (40km/h). And if you do break it, you can just upcycle more cardboard and trash bags to revive it. It runs really well on flat surfaces, tarmac, and concrete.

» Upgrade for Water Use

With a few modifications your hovercraft runs really well on water too, but be warned that the cardboard base is no good for water. Instead, use thick packaging foam (Figure DD) as a great hovercraft base for water racing.

TIPS AND TUNING

Make sure the skirt inflates well. If it's too tight you can try stretching the bottom plastic a bit to create more room for the air to find the four corner holes.

Start by racing slow and learning how to control your hovercraft, then increase the speed. But always make sure to race in a safe space.

It's cheap and easy to modify the skirt, fin, linkages, and prop guard (air duct) length to tune your craft to your liking (Figure EE). I really hope you'll have a lot of fun racing and experimenting with your cardboard hovercraft!