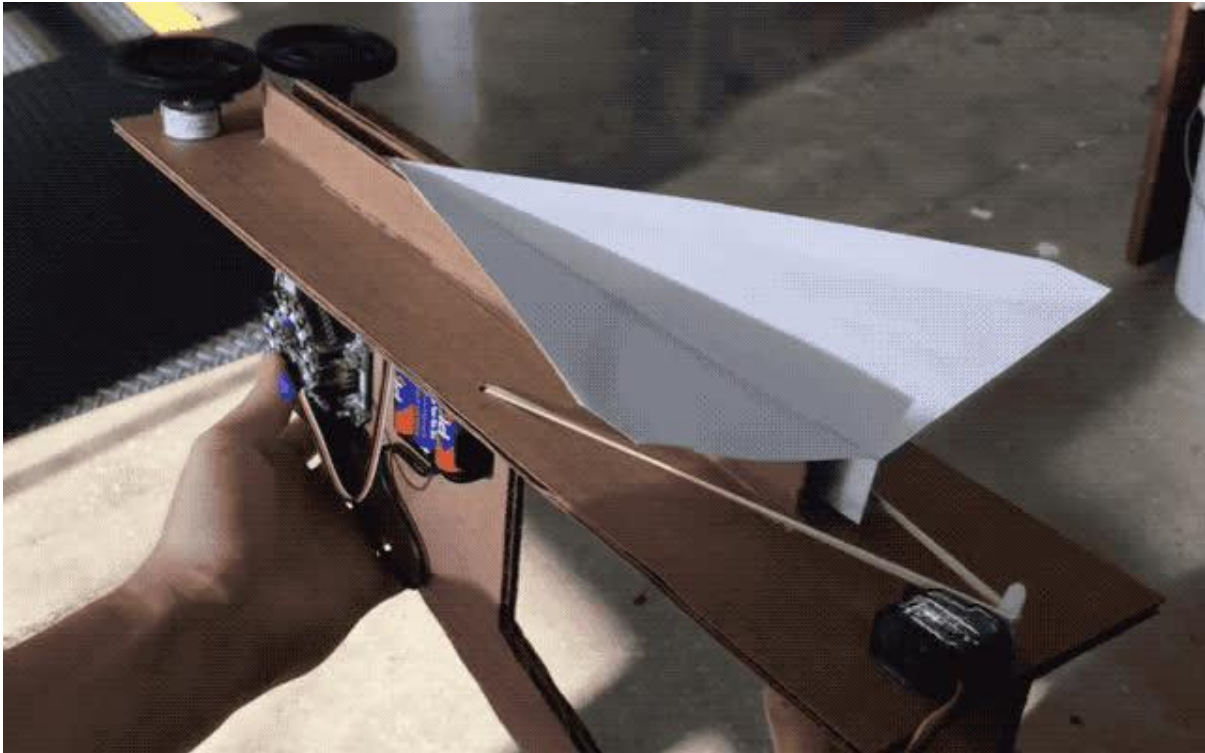




Paper Airplane Launcher

Created by Dano Wall



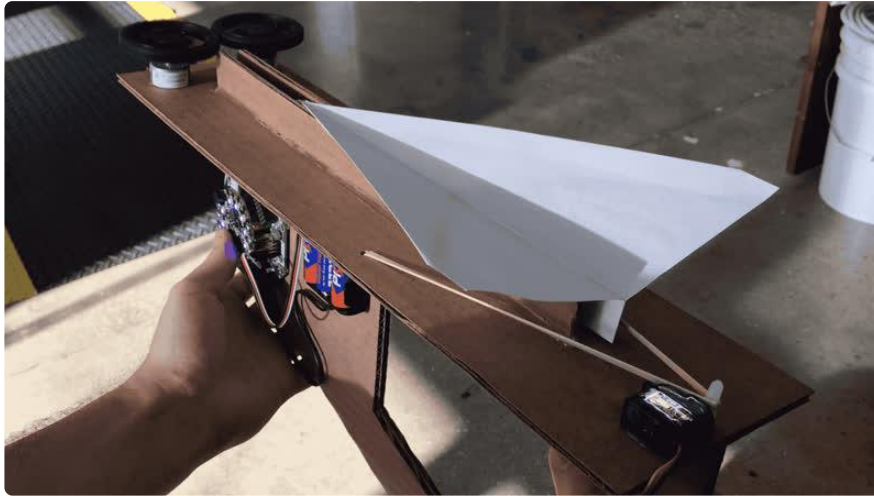
<https://learn.adafruit.com/paper-airplane-launcher-with-CRICKIT>

Last updated on 2021-11-15 07:19:38 PM EST

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Overview



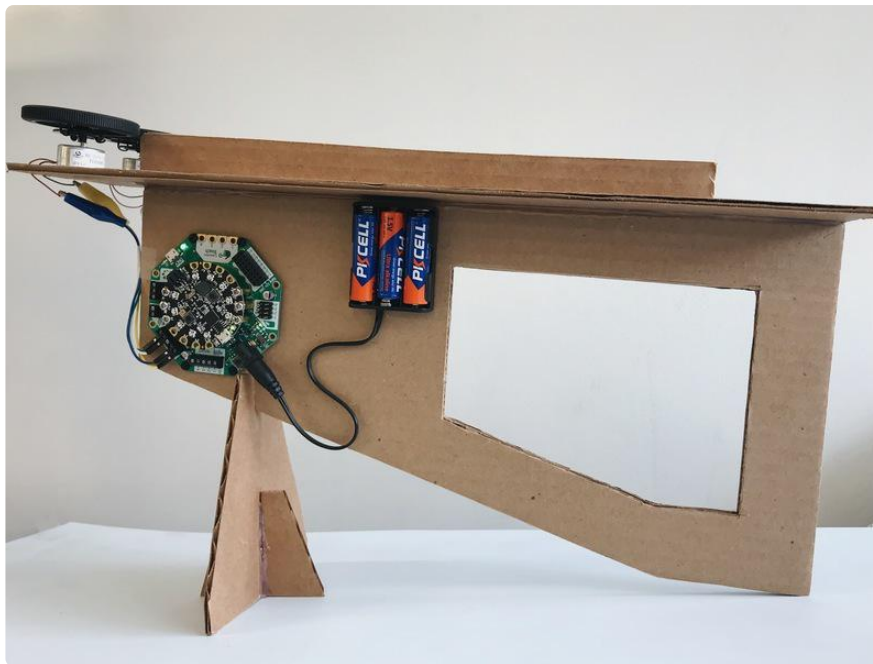
A Launching Platform

The [science of paper airplane folding \(https://adafru.it/Cn6\)](https://adafru.it/Cn6) is a great way to learn about flight. This guide takes you through the process of building a motorized paper airplane launching platform. This can be used for fun, or as a standardized way to test different airplane designs.



The tools and materials for this project (aside from the motors and microcontroller) are things you can find around the home or in any craft store. Paired with the versatile robotics platform, [CRICKIT for Circuit Playground Express \(https://adafru.it/Biy\)](https://adafru.it/Biy), simple household materials can spring to life and take on any form your imagination desires!

This project demonstrates basic programming skills using [Microsoft MakeCode \(https://adafru.it/BUu\)](https://adafru.it/BUu) and allows for easy experimentation and adaptation.



The Electronics

In addition to the household materials listed below, you'll also want to pick up the following electronics:

1 x [Circuit Playground Express](https://www.adafruit.com/product/3333)

<https://www.adafruit.com/product/3333>

Circuit Playground Express is the perfect introduction to electronics and programming

1 x [Adafruit CRICKIT for Circuit Playground Express](https://www.adafruit.com/product/3093)

<https://www.adafruit.com/product/3093>

Creative Robotics and Interactive Construction Kit is an add-on to our popular Circuit Playground Express

2 x [CD DVD Spindle Motor](https://www.adafruit.com/product/3882)

<https://www.adafruit.com/product/3882>

These motors are typically found inside CD or DVD players and have some great benefits that make them easier to use than '130' style hobby motors

1 x [Sub-micro Servo - SG51R](https://www.adafruit.com/product/2201)

<https://www.adafruit.com/product/2201>

This tiny servo can rotate approximately 180 degrees and works just like a standard servo but much smaller. Good for beginners who want to make stuff move. You can use any servo code, hardware or library to control these servos.

1 x [Servo Extension Cable - 30cm / 12" long](https://www.adafruit.com/product/972)

<https://www.adafruit.com/product/972>

Stretch out your servo connections with this flexible servo extension cord. It has a 3 pin shrouded "male" connector to plug your servo into and then, 30cm later, a 3 pin female connector.

2 x [Wheel for Micro Continuous Rotation Servo](https://www.adafruit.com/product/2744)

<https://www.adafruit.com/product/2744>

This black plastic servo wheel is equipped with a silicone tire and a press-fit design to make connecting to a servo motor quick and easy

1 x [Small Alligator Clip to Male Jumper Wire](https://www.adafruit.com/product/3448)

<https://www.adafruit.com/product/3448>

These compact jumper cables have a premium male header on one end and a grippy mini alligator clip on the other

1 x [3xAA Battery Holder with DC jack](https://www.adafruit.com/product/3842)

<https://www.adafruit.com/product/3842>

Battery holder 3xAA batteries with 2.1mm DC jack

1 x [Alkaline AA batteries - 3 pack](https://www.adafruit.com/product/3521)

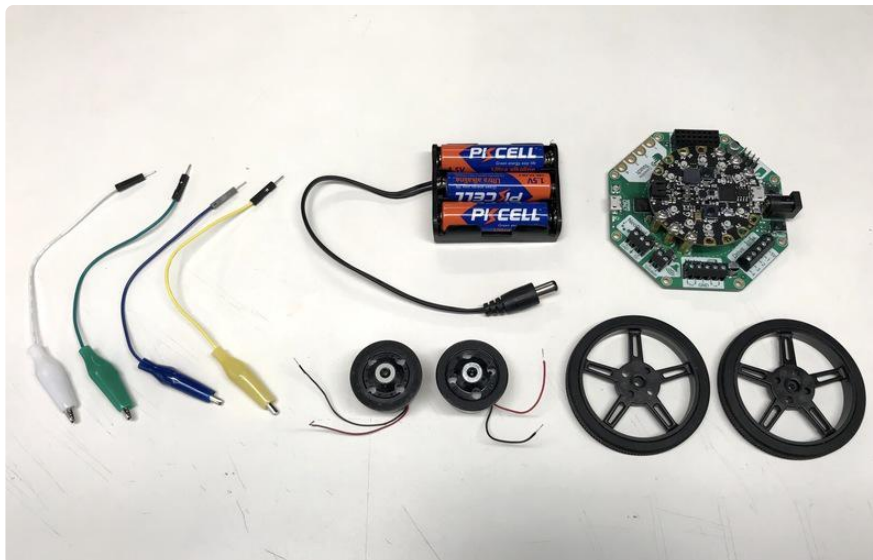
<https://www.adafruit.com/product/3521>

These batteries are good quality at a good price, and work fantastic with any of the kits or projects that use AAs

1 x [USB cable - A/MicroB - 3ft](https://www.adafruit.com/product/592)

<https://www.adafruit.com/product/592>

Standard A to micro-B USB cable



Materials

For this project you will need:

- Some large pieces of scrap corrugated cardboard
- Scissors and/or box cutter
- Hot glue & hot glue gun
- Rubber band
- [Double-sided foam tape](https://adafru.it/Cni) (<https://adafru.it/Cni>)
- Pen/pencil
- Small screwdriver



Build the Launcher

To build our launching platform we'll need a couple large pieces of scrap cardboard. A pen and ruler can be helpful for marking where you want to cut.

If you don't have an X-acto knife or similar, the 3D printed handle pictured in this guide can be found on [Thingiverse](https://adafru.it/BPp) (<https://adafru.it/BPp>) and pairs well with standard utility knife blades to make an excellent hobby knife.

Be careful using a hobby knife, they are sharp! Have someone help you if you need help.



Trace the outline for your handle on a large section of cardboard.

Cut around the outside using scissors. A knife is useful for cutting out the inner portions.

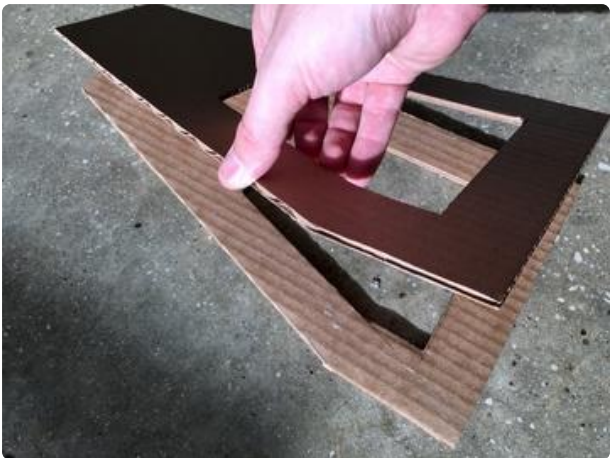


Cut out two copies. This will ensure the handle is substantial enough to mount everything else on.

Glue both sides together. A glue stick, white glue or hot glue will work in this situation.

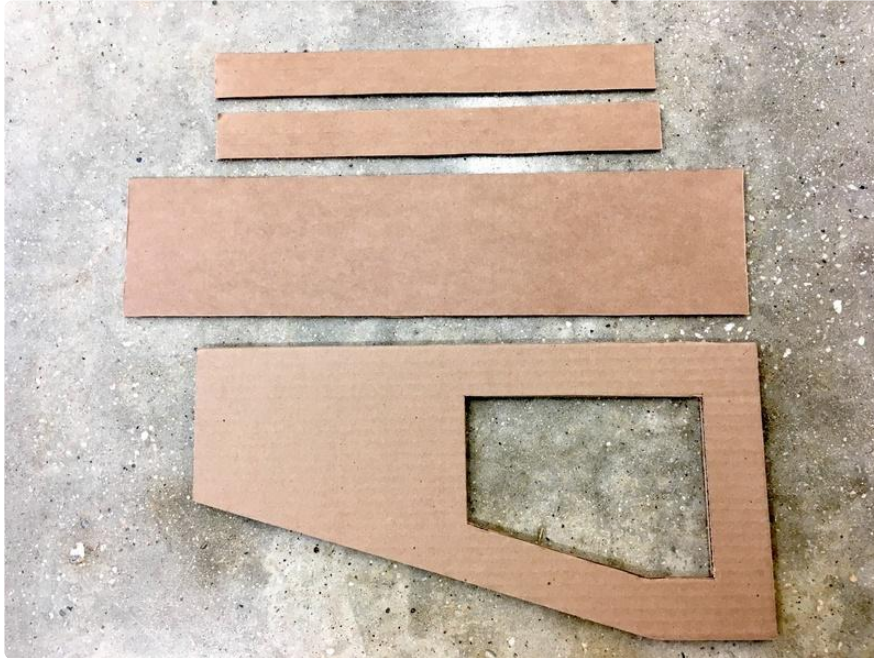


Press hard for 15 seconds, wait for glue to take hold.



Cut out a "runway", about 3 inches wide and long enough to extend 2 inches past the end of your handle.

Also cut out two "guide rails". These should be about 1 inch tall and a couple inches shorter than the length of the handle.



WARNING! BURN HAZARD! Hot glue is very sticky and it's easy to accidentally burn your fingertips. Be careful when using it.



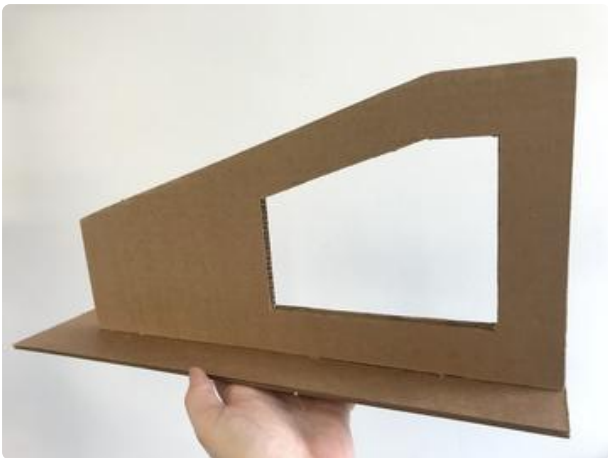
Glue runway to handle.

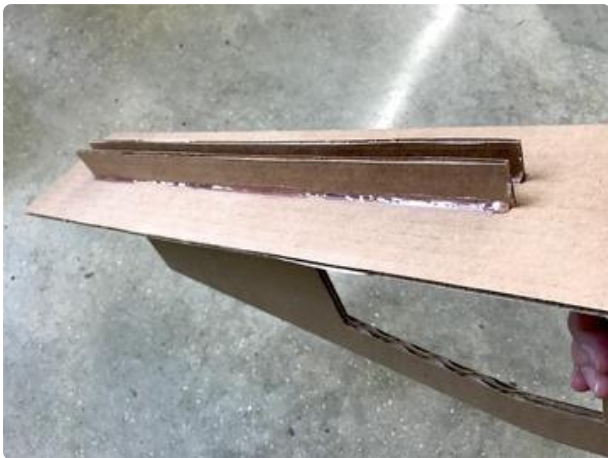
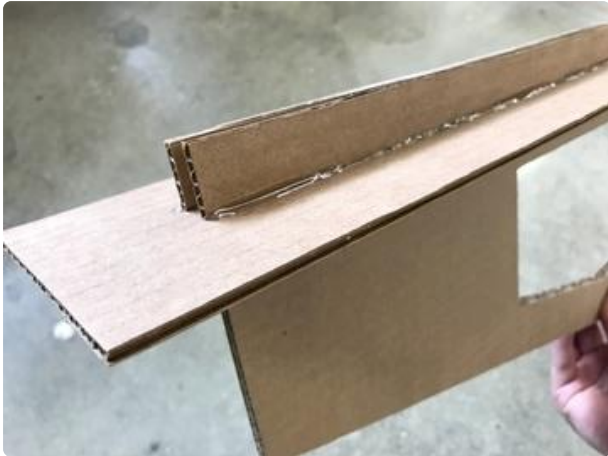
Leave excess length hanging off front end.

Center rails on runway, use hot glue to stick in place.



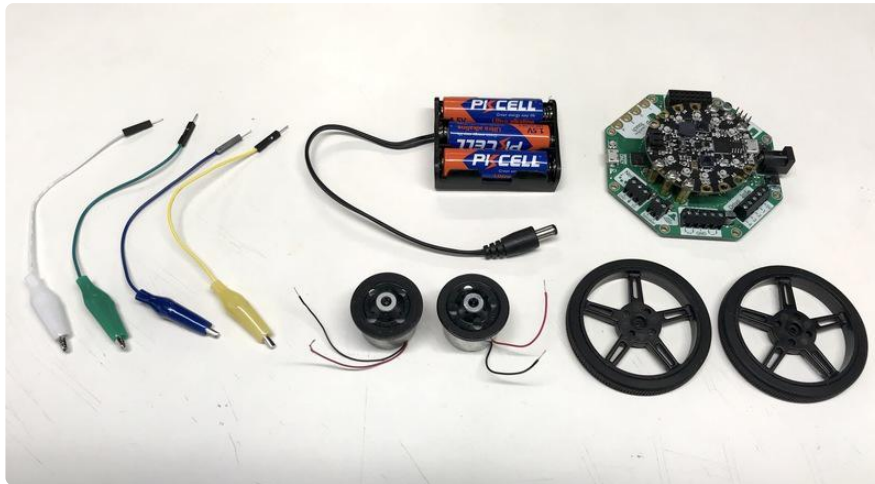
Guide rails should be about 1/2" - 3/4" apart.





Once you have a nice looking cardboard launch platform we can move on to electrifying it.

Attach Motors & CRICKIT



The servo wheel centers itself conveniently on top of the CD/DVD motor. Place it on the motor to feel where it engages.

Now all we need to do is attach them together. You can use wire, twist ties, or even hot glue to make the connection.

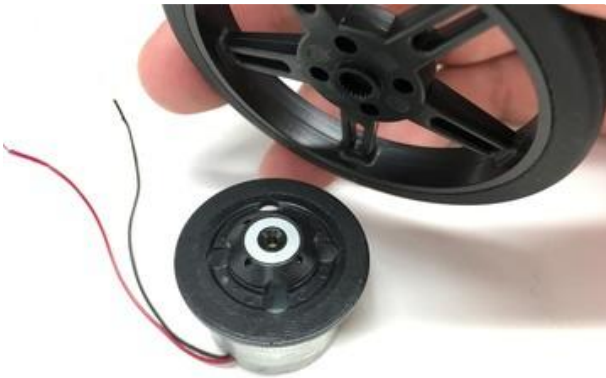


Motor Upgrade



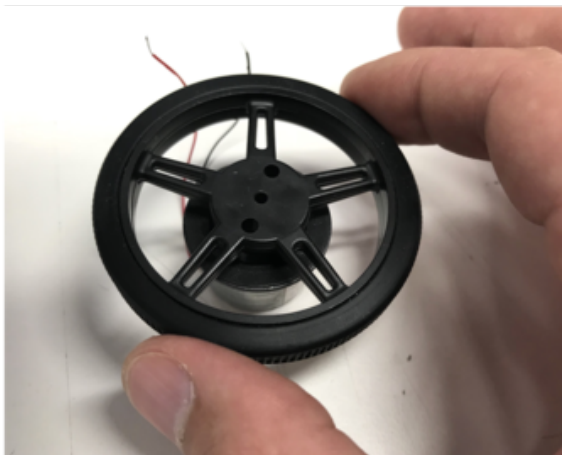
These wheels come with a grippy rubber ring, which will grab and launch paper airplanes with vigor.

In addition, by effectively extending the diameter of the motor hub, we increase the speed achieved at its outer edge, so the planes will launch at an even higher velocity.

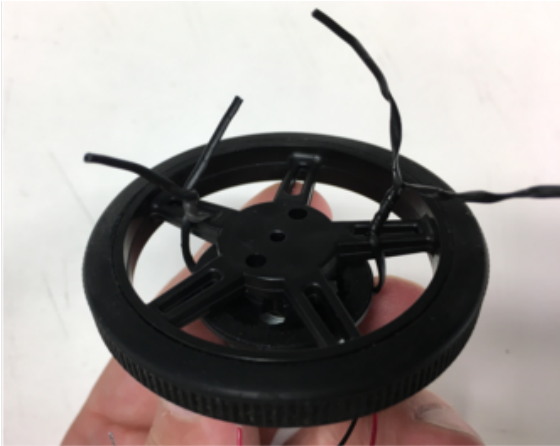


Use wire or twist-ties to attach servo hubs to CD/DVD motors.

It's ok if they aren't perfectly evenly spaced, as long as the wheel remains fairly well-balanced.

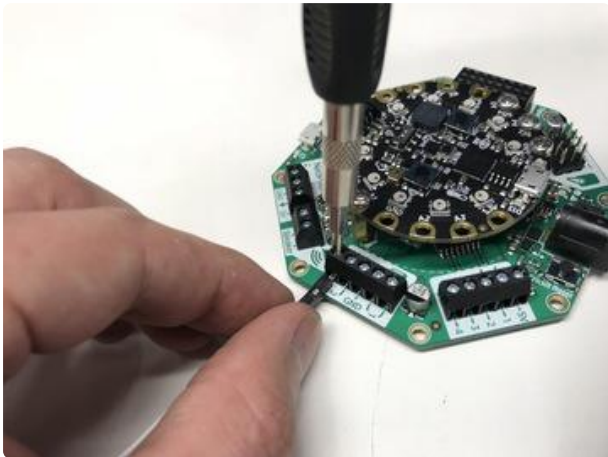


Clip off any excess wire.



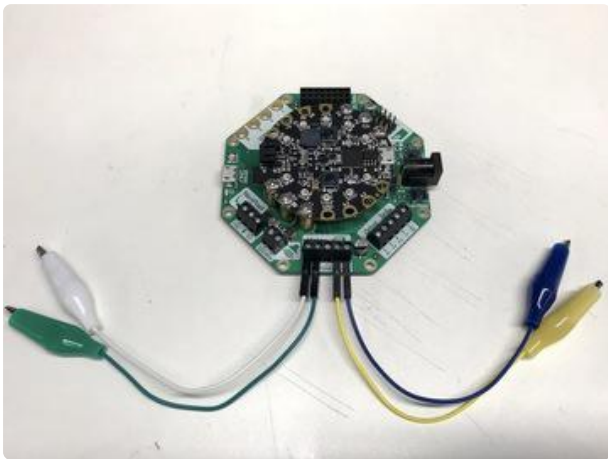


Connect Motors to CRICKIT



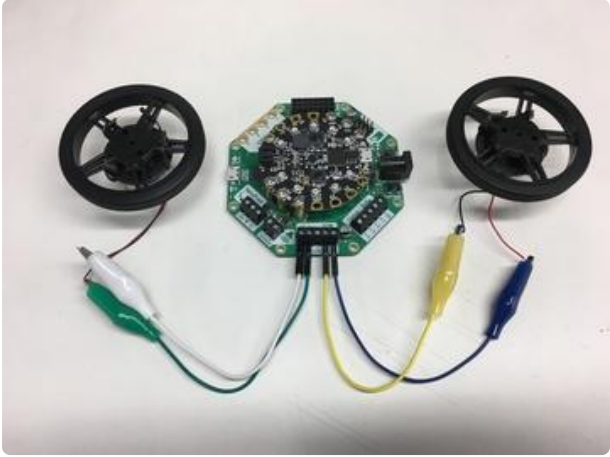
Now time to connect both motors to CRICKIT!

Use a small screwdriver to connect the jumpers.

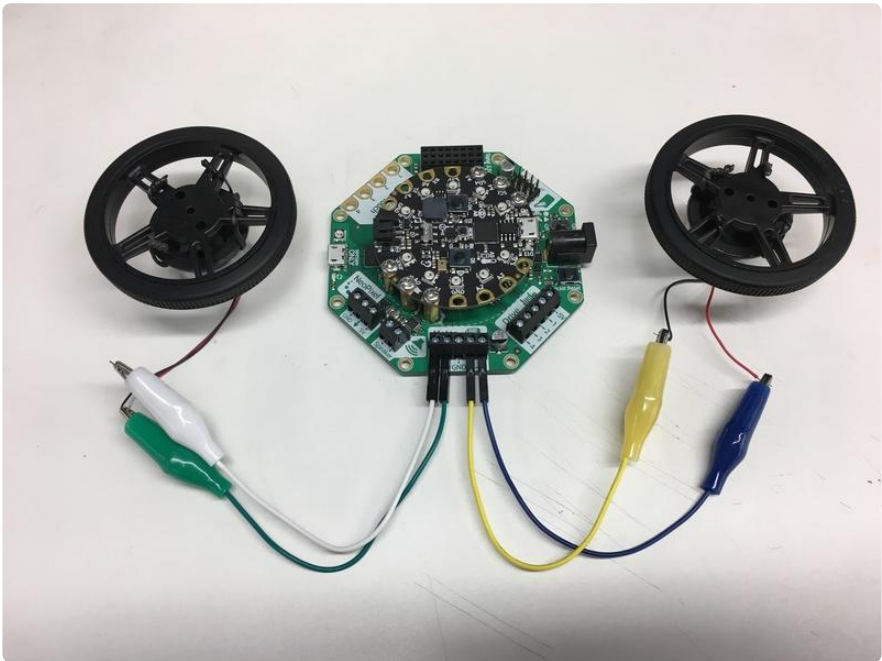


Now connect the alligator clips to the ends of the motor wires. (Check to make sure there is enough wire stripped at the end to make a good connection.)





Now that we've made the necessary connections, it's time to mount everything to the cardboard launcher!



Attach Battery to Launcher



Stick battery pack to launcher with double sided foam tape.

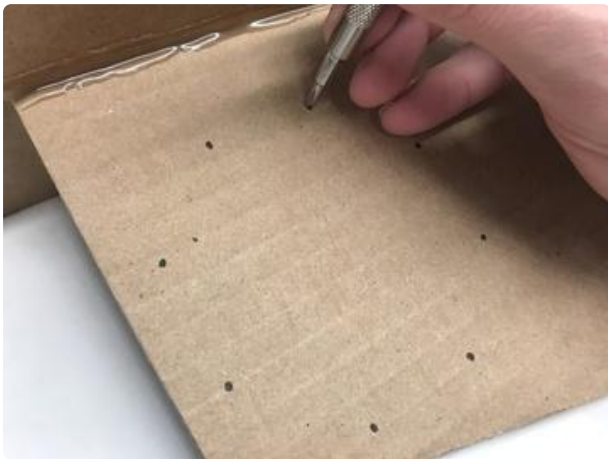


Attach CRICKIT to Launcher



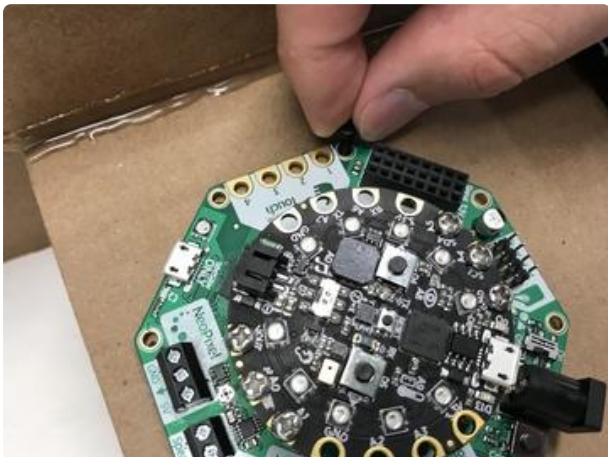
If you'd like to use something slightly less permanent than hot glue or double sided tape, some short screws will do the trick

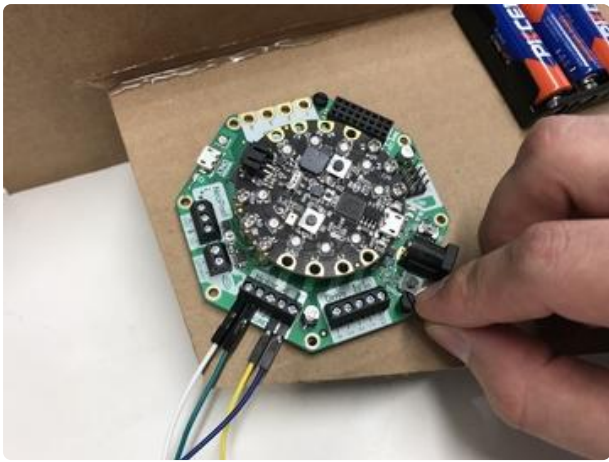
Mark position of 4 holes around outside edge.



Poke holes using pen or screwdriver.

Use screws or twist ties to hold CRICKIT in place.





Glue on Motors



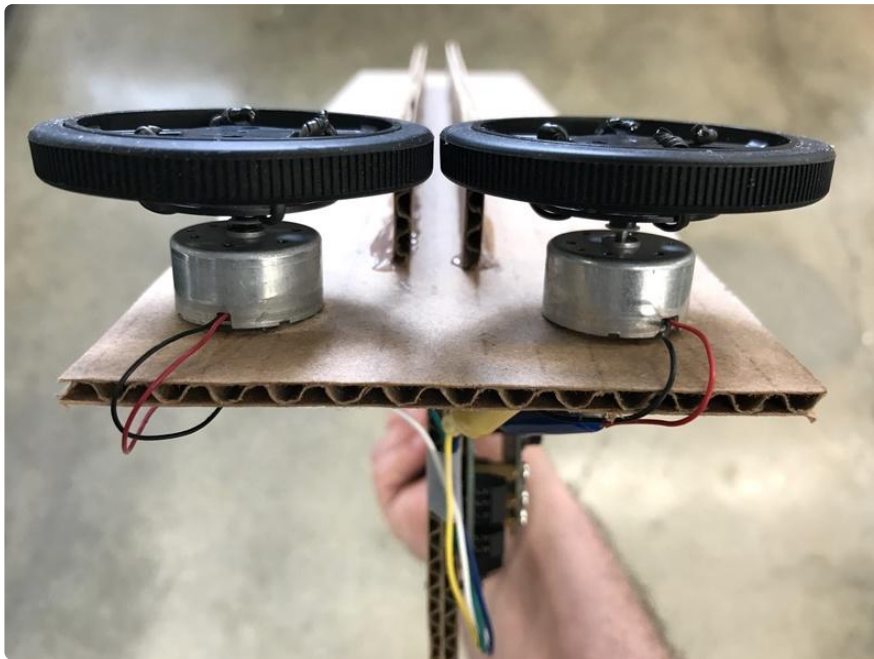
Mark placement of motors with pen or pencil.

Check carefully to make sure a small (~1/16") gap remains between the two wheels.



Glue motors to end of launcher.





Let's upload some code!

Coding with MakeCode

Now it's time to upload some code! For this we will be using Microsoft MakeCode for Adafruit, a web-based code editor. It provides a block editor, similar to Scratch or Code.org, and also a JavaScript editor for more advanced users.

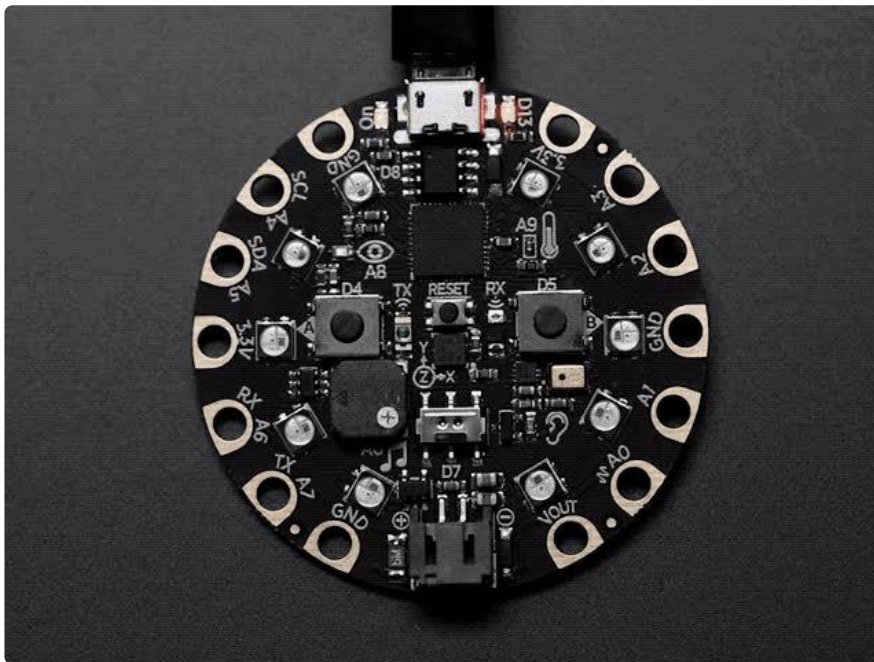
If you haven't used MakeCode before, [this guide is a good place to start \(https://adafru.it/BDk\)](https://adafru.it/BDk).

Getting into Bootloader Mode

Your Circuit Playground Express board comes ready to work with CircuitPython. When you connect the board to your computer for the first time, it will appear as a flash (or thumb) drive named CIRCUITPY.

BUT

We'd like to make it work with MakeCode, which is done by putting it into "bootloader mode". All that's required to do this is to connect the board to your computer with a micro USB cable and click the small reset button in the center of the board.

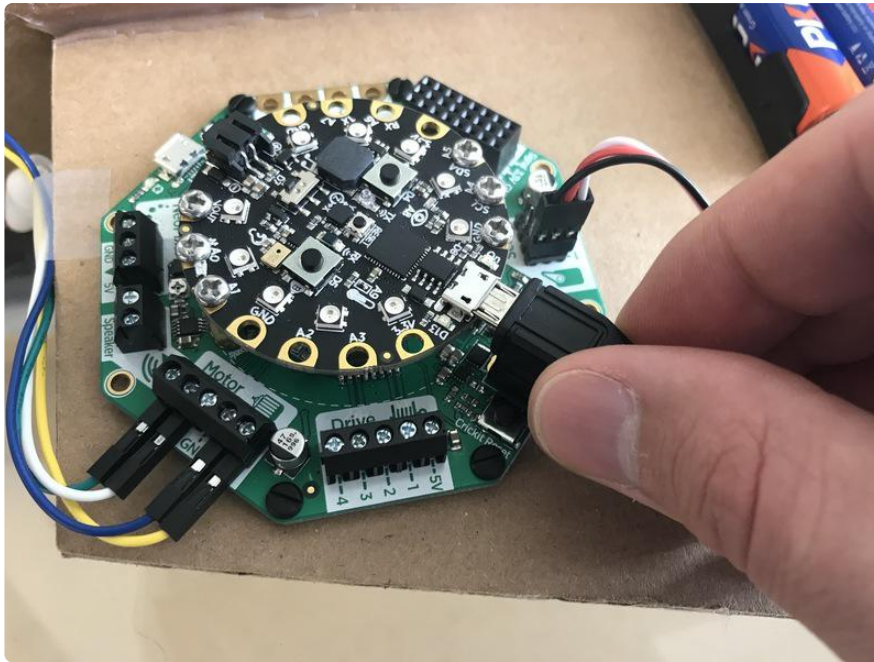


The Code

Click the green button below to interact with the code used in this project.

Open this example in MakeCode

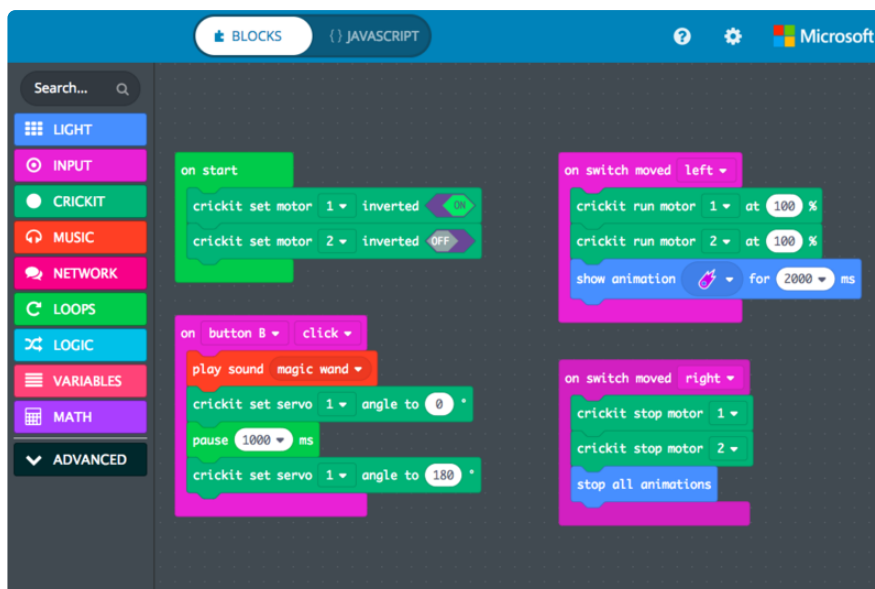
<https://adafru.it/Cnj>



How to upload code

To upload code, connect your Circuit Playground Express to your computer using the micro USB cable, click the Download button to download the .uf2 file to your computer, and drag 'n drop it onto the CPLAYBOOT drive.

The drive will automatically eject itself. (Your computer may give you a "failed to eject drive correctly" error, you can ignore this.) The code is now on your Circuit Playground Express and ready to run!

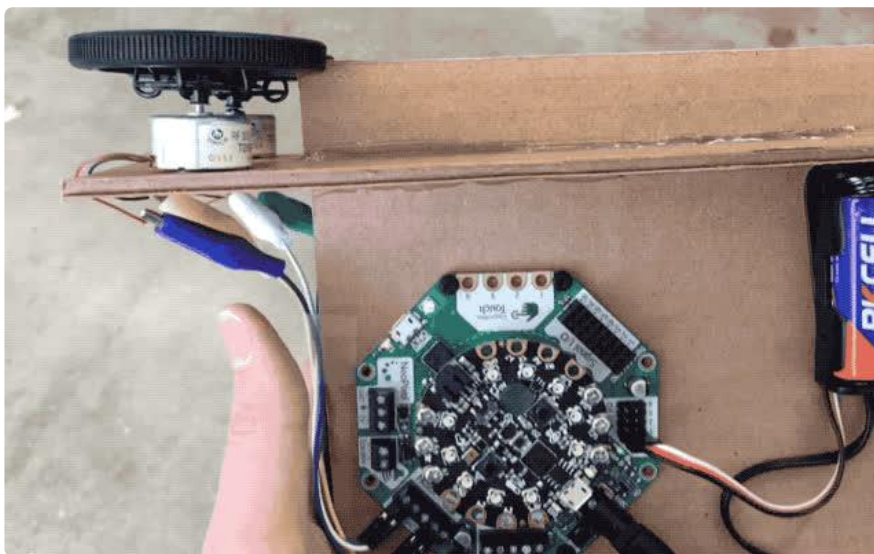


Understanding the Code

This code template allows for control of both the spinning DC motors that launch the plane, and a servo motor (optional) that can be used as a trigger.

To turn on the spinning wheels, flip the mini slide switch to the Left. To turn those motors off, flip the switch to the right.

If either of your wheels are spinning in the wrong direction, you can change the `crickit set motor 1 inverted` and `crickit set motor 2 inverted` to ON or OFF to change the direction of spin.



If you'd like to change the direction the wheels spin without changing the code, unclip the alligator clips connecting the motors to Crickit and switch their positions.



Troubleshooting

Problem: My motors aren't spinning!

Solution: Make sure that the small slide switch on the CRICKIT is set to "ON".

Problem: My Circuit Playground Express doesn't show up as CPLAYBOOT!

Solution: Your Circuit Playground Express board comes ready to work with CircuitPython, and will show up as a flash drive named CIRCUITPY the first time it's connected to your computer. To switch over to work with MakeCode, connect the board to your computer with a micro USB cable and click the small reset button in the center of the board.

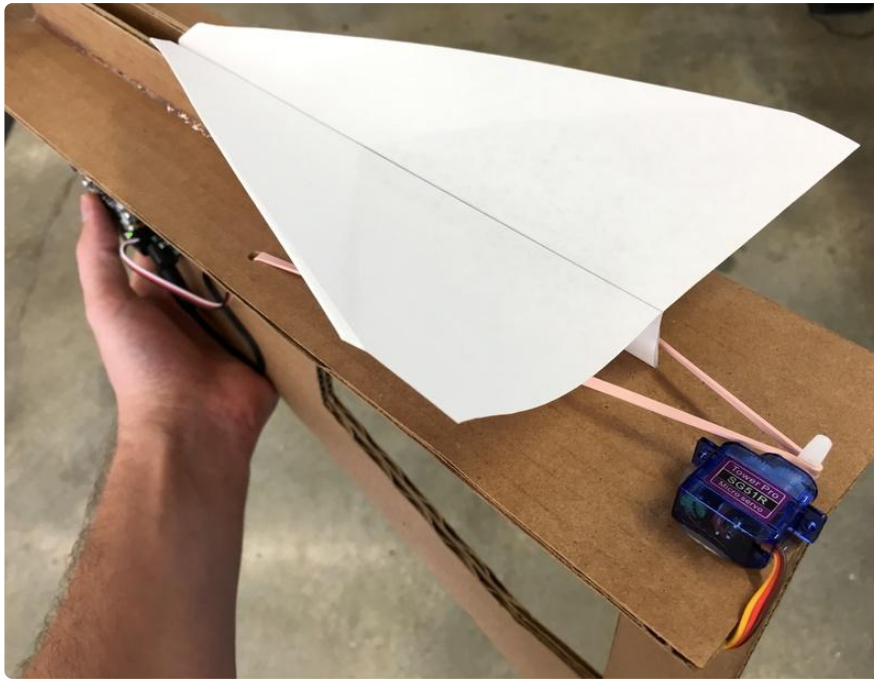
When Circuit Playground Express is in Bootloader mode, all the LEDs will flash red briefly, then turn green. Your computer should now show removable drive called CPLAYBOOT. Now you can copy the MakeCode file to the CPLAYBOOT flash drive.

Add a Trigger

To take this project further, it's possible to add a trigger to your launcher so you don't have to feed airplanes manually into the wheels.

For the trigger mechanism, we can use a tiny servo motor and a rubber band. Luckily, CRICKIT is capable of controlling multiple different types of motors simultaneously, so all that's needed is to plug the servo in.

If you haven't used servos before, the servo section of the [Adafruit Motor Selection Guide \(https://adafru.it/scS\)](https://adafru.it/scS) will provide a good introduction.



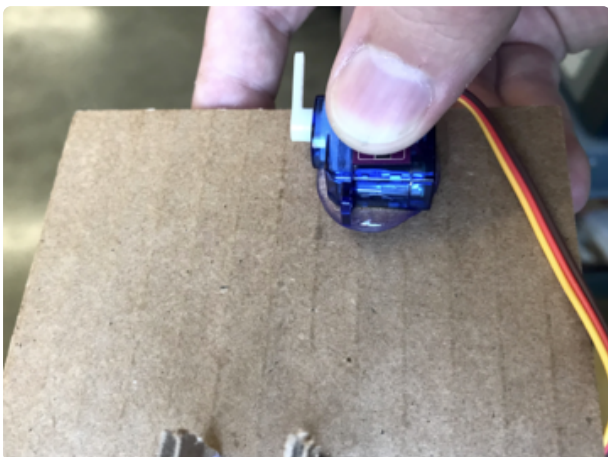
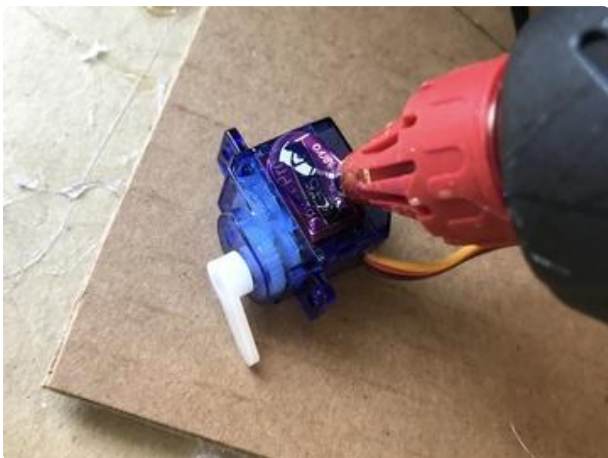
Connect servo to CRICKIT so that the brown/black GND wire is facing IN!

Mount Servo

Mark placement of servo on the back edge of the platform.

Be careful to place it so the servo horn is centered perfectly between the guide rails.

Attach servo motor with hot glue.



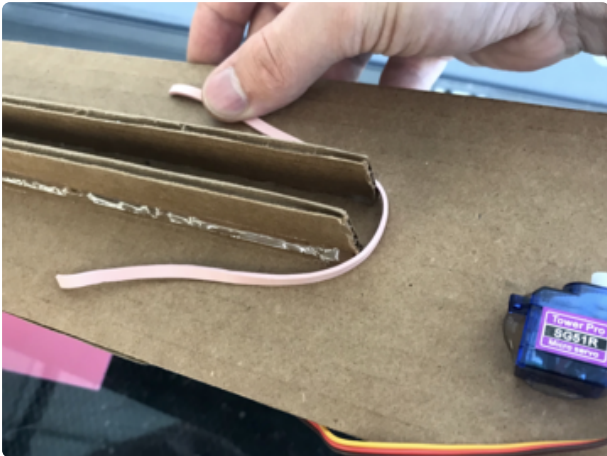
You may need a servo extension cable to get the servo cable long enough to reach the Crickit based on where you mount things. [Adafruit carries the cable as product #972 \(https://adafru.it/CnV\)](https://adafru.it/CnV).

Remove servo horn before running this for the first time, so you can see the full extent of the servo's rotations.



Pressing the "B" button on Circuit Playground Express will now activate the trigger and play a notification sound.

Attach Rubber Band



Cut through a rubber band.

Lay rubber band on launch platform to measure where to mount it.

Poke holes in cardboard where rubber band will be attached.



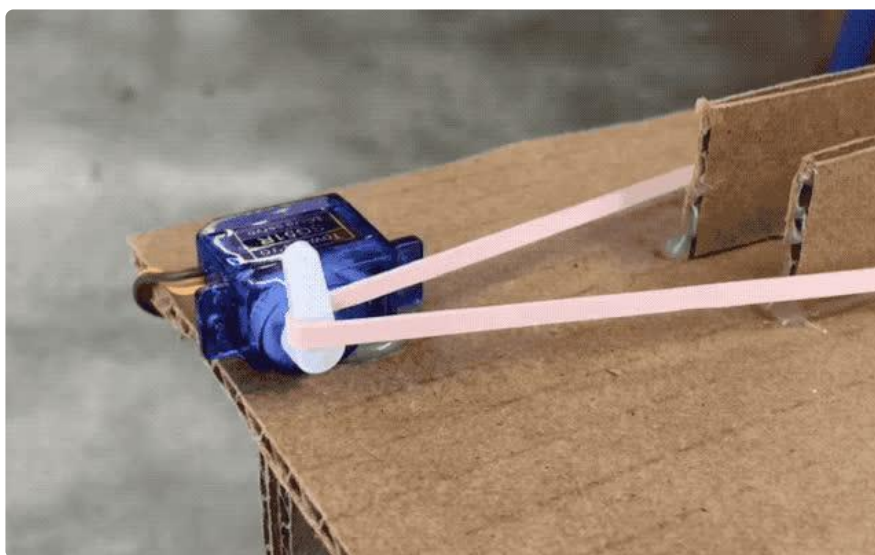
Stick ends of rubber band through holes and tie off the ends.



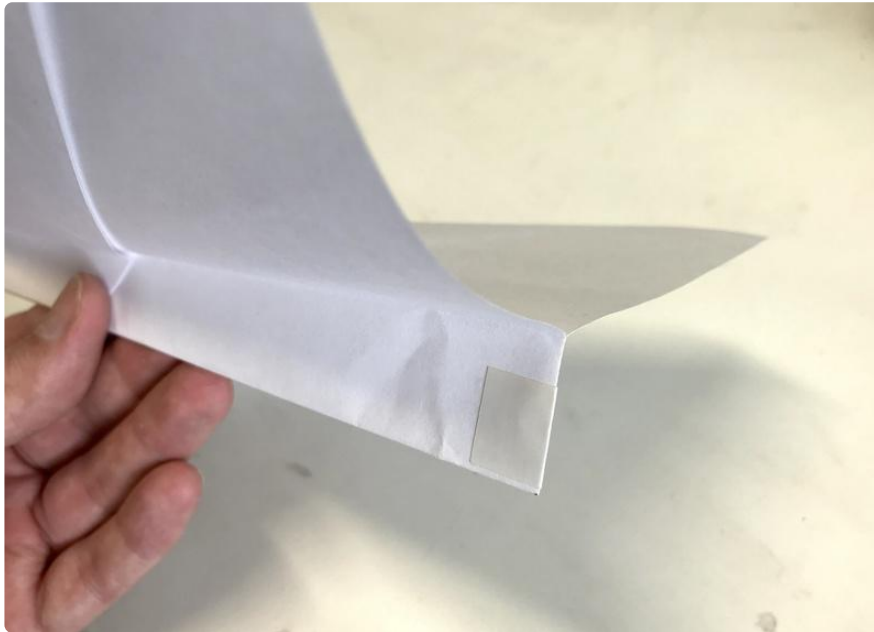


You should now be able to cock back and release your rubber band, which will push your paper airplane forward into the launching wheels.

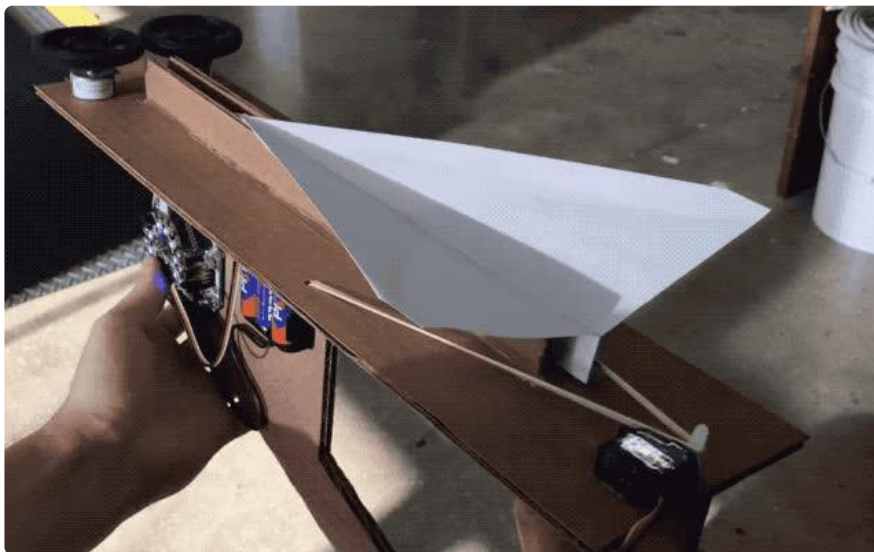
Note: servo needs to be powered ON to hold rubber band back. Without power it will rotate freely.



It is recommended that you use a small piece of tape to strengthen the back edge of the paper airplane so that it's stiff enough to withstand the impact of the rubber band.

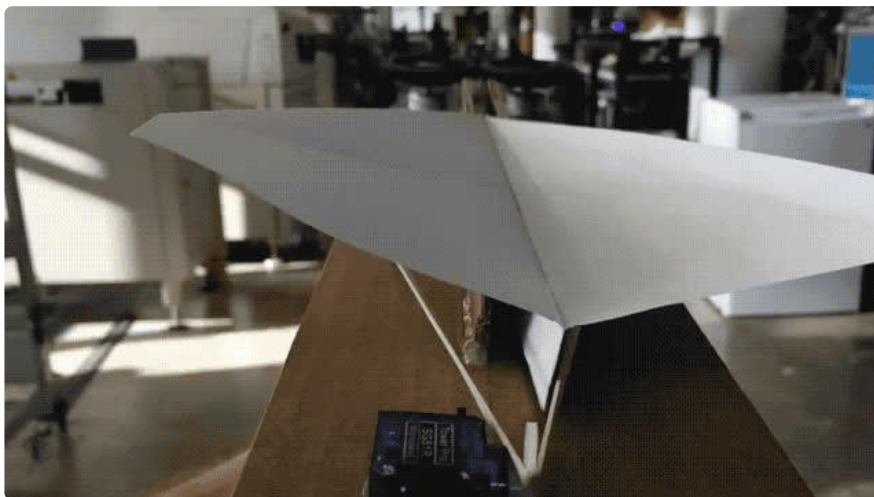
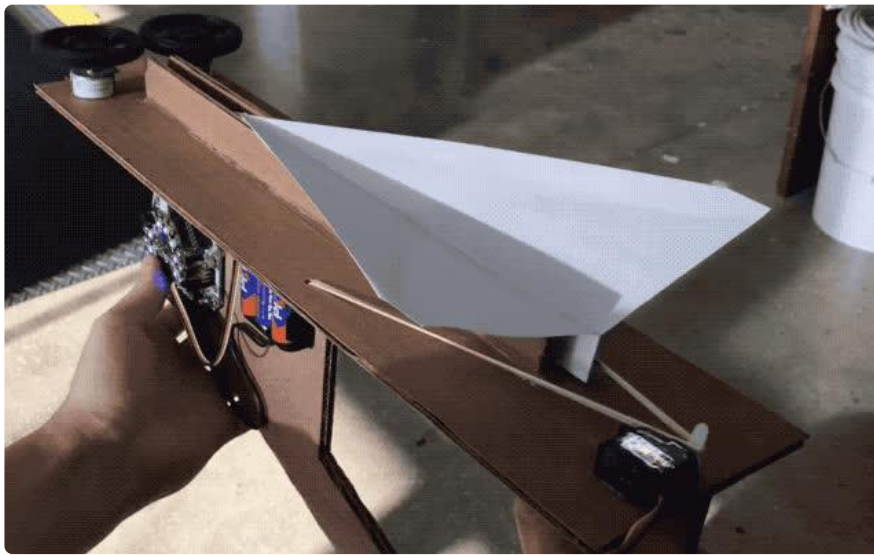


You are now GO for launch!



Launch Paper Airplanes!

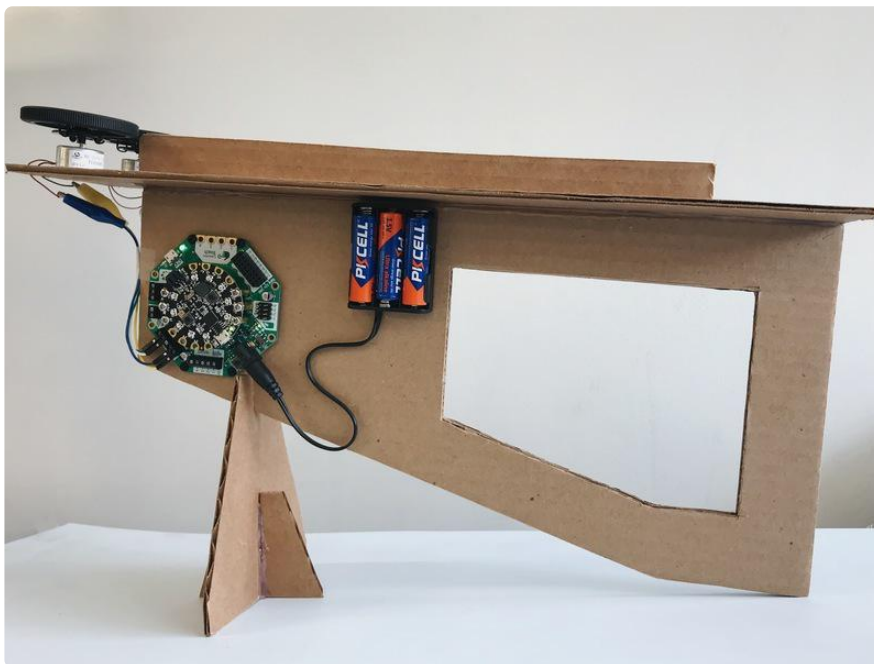
Once your code is uploaded and your CRICKIT is powered on, it's time to test some airplanes!





Optional: Build a tripod

A cardboard tripod can be helpful for propping up the launcher.



If you want to continue exploring you can check out [lots more MakeCode projects on the Adafruit Learn System \(https://adafru.it/Bwv\)](https://adafru.it/Bwv).