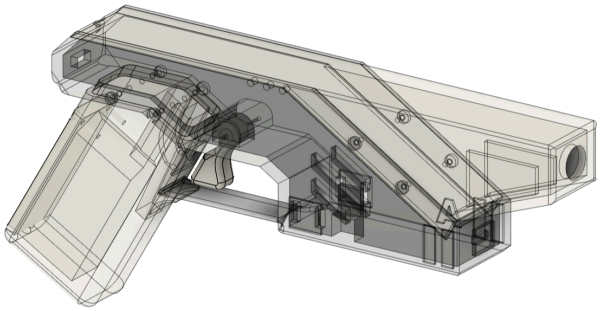


GlowBlaster Build Guide

Overview

This blaster toy uses an Arduino Nano microcontroller board to pulse a 405 nm laser, imprinting green dots on phosphorescent (glow-in-the-dark) targets. The casing is 3D printed PLA designed to resemble a Mandalorian blaster from The Clone Wars (Webster 35). Anything that is glow-in-the-dark works as a target. There are 5 firing modes, plus an option to enable reloading functionality. Overall, the build cost for this project is approximately $25 in materials (but it will probably cost you more if you need to purchase *everything* new).

The inspiration for this project came from a few places. To start, many existing blaster toys can be inaccurate. Namely, my Nerf guns and commercial laser tag blasters never seem to really shoot where I aim them. When I was younger, I saw a demonstration of a violet laser pointer causing glow-in-the-dark paper to glow. High photon energy (i.e. high frequency) light is able to excite phosphorescent materials, causing them to glow for minutes on end. This got me thinking and eventually led to this project.

This blaster is the fourth version in a lineup of similar blasters I started building in high school. The first one was actually built inside of a Nerf Jolt (though I wouldn't recommend trying this; there was a huge cardboard chuck hanging off the bottom for electronics). Crucially, the blaster is in no way dependent on its current form factor, and modifications are entirely encouraged.

Have fun building GlowBlaster!

Disclaimer: Lasers of any type should never be pointed at the eyes, for risk of permanent retinal damage. Be wary of pointing GlowBlaster at reflective surfaces. Build and use at your own risk.

Parts Required

Below is a list of materials required for this project. Please note that it may be difficult to buy some of these individually, or in small quantities for a reasonable price.

- PLA filament (1 spool is more than enough)

- 12 M2 0.4 plastic screws (~6-8 mm in length)
  - Small Parts Steel Machine Screw, Zinc Plated Finish, Pan Head, Phillips Drive, 8mm Length, M2-0.4 Metric Coarse Threads (Pack of 100): Amazon.com: Industrial & Scientific
- Solid core 22AWG wire
  - Solid-Core Wire Spool - 25ft - 22AWG - Black : ID 290 : Adafruit Industries, Unique & fun DIY electronics and kits
  - 22 Awg Solid Wire Electrical Wire Cable 22 Gauge Ul1007 - Temu
- Arduino Nano (USB type C) WITH UNSOLDERED PINS
  - Atmega328 Mini Type c Nano 3.0 Usb V3.0 Atmega328p Ch 5v - Temu
  - Amazon.com: AITRIP 2PCS Type-C USB Nano 3.0 ATmega328P CH340 5V 16MHz Compatible with Arduino Nano CH340 USB Driver Nano V3.0 ATmega328 : Everything Else
- 9 volt battery
  - Amazon.com: Amazon Basics 4-Pack 9 Volt Alkaline Everyday Batteries, 5-Year Shelf Life : Health & Household
- 9 volt battery clip
  - Battery Clip Connector I type 9v 9 Volt Battery Clip Faux - Temu
- 405 nm “5 mW” violet laser pointer
  - High Power Military uv405nm Purple Laser Pen Visible Beam Light Lazer Pointer | eBay
  - Note: These “ebay lasers” are pretty much all the same, and are infamous for outputting more power than 5 mW. They may warrant the use of safety glasses, depending on your risk propensity. Styropyro has a video on YouTube explaining more: eBay laser pointers are DANGEROUS!!! (youtube.com)
- Vibrating mini motor disk
  - Vibrating Mini Motor Disc : ID 1201 : Adafruit Industries, Unique & fun DIY electronics and kits
  - Mini Vibration Motors 3v 12000rpm Flat Coin Button type - Temu
- 8 ohm .5 W speaker
  - Mini Metal Speaker w/ Wires - 8 ohm 0.5W : ID 1890 : Adafruit Industries, Unique & fun DIY electronics and kits
- 3x mini blue LEDs
  - Diffused Blue 3mm LED (25 pack) : ID 780 : Adafruit Industries, Unique & fun DIY electronics and kits
- 3x 12 mm square, 6 mm tall tactile buttons
  - Tactile Switch Buttons (12mm square, 6mm tall) x 10 pack : ID 1119 : Adafruit Industries, Unique & fun DIY electronics and kits
- 1x 1000 ohm resistor, 2x 10 ohm resistor
  - 130 Values / 30values 1 Ohm 118.11inchohm Metal Film Full - Temu
- SPDT switch
  - Breadboard-friendly SPDT Slide Switch : ID 805 : Adafruit Industries, Unique & fun DIY electronics and kits
  - Toggle Switch Vertical Slide Switch Toy Battery Box Switch - Temu
- 3x 2N2222 or 2N3904 transistor

    - Transistor Kit 92 2n3904 2n3906 2n0907 Bc547 C1815 Npn Pnp - Temu
    - NPN Bipolar Transistors (PN2222) - 10 pack : ID 756 : Adafruit Industries, Unique & fun DIY electronics and kits
- Narrow perf board (optional)
    - Double Sided Pcb Board Prototype Kit Soldering 6 Sizes - Temu
- A paperclip
- Glow-in-the-dark materials for targets (see “Targets” below)

For this project, you will also need the following equipment: 3D printer (probably FDM), glue gun + glue, sandpaper, super glue, 4 mm Phillips screwdriver, laptop/pc, pliers, support removing tool(s), soldering iron + solder, multimeter.

Printing

A good first step is printing the parts in the *printable_stls* folder. It is recommended that you print in PLA due to its ease of printing, cost-effectiveness, and rigidity. However, other materials (e.g. PETG) may suffice. Layer height and speed should not matter much; choose whatever lends itself to acceptable quality and print time. I recommend using 3 perimeters and tree (“organic”) supports attached to the build plate. Ensure that each part is oriented in a way that minimizes overhangs and maximizes layer cross-sections. Use a brim on the piece *front* to prevent warping.

Arduino Code

To upload the code to your Arduino Nano (clone), open *blaster_v3_code.ino* in the Arduino IDE (Software | Arduino). In the tools menu, ensure that “Arduino Nano” is your selected board and “ATmega328P” is your selected processor.

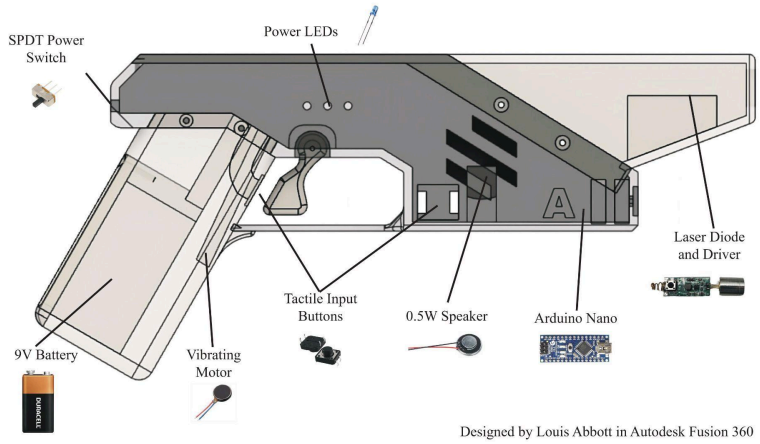
In order to store the laser firing noise without external memory, I make use of the Arduino PCM library (PCM - Arduino Reference). You will need to install it from the Library Manager in the Arduino IDE.

It is likely that the Arduino Nano clone requires a CH340 driver on your computer to communicate with the board. You might need to try a few to find one that works (be careful of downloading malware) but here’s a good starting spot: How to Install CH340 Drivers - SparkFun Learn.

When all of this is complete, you can connect your board via USB and upload the provided code.

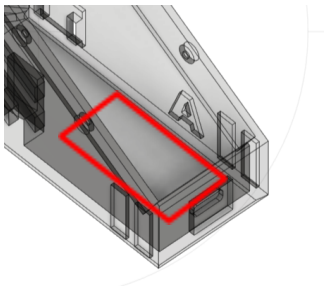
Part Locations

This section will serve as a reference as you read and complete the sections to follow.

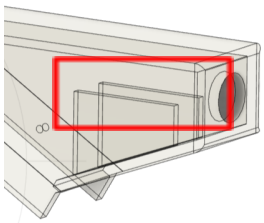


Below are more details on the location of each part:

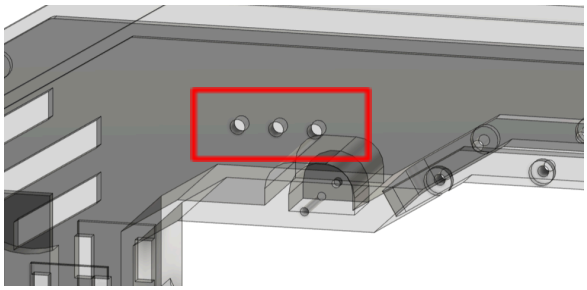
- The Arduino board belongs at the bottom of the *center* piece, with its USB C port protruding from the small hole in front. The Arduino must be situated parallel to the base of this piece and facing upward to make this orientation possible. It must be hot-glued into place as well.



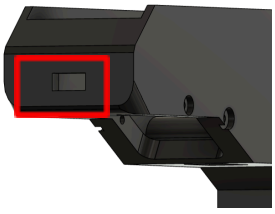
- The laser diode and its driver board sit atop the two thin support bodies within the *front* piece. The aluminum casing should protrude slightly from the front, and it should be hot glued in place from the outside. When wiring the laser to the Arduino, I recommend providing considerable slack to make it more maneuverable.



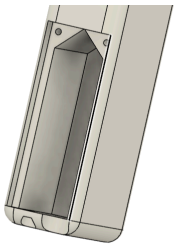
- The blue LEDs get inserted through the three holes in the side of the *center* piece, from the inside. Ensure that the “leftmost LED” is indeed in the leftmost slot (when looking from the outside of the blaster). If a mistake is made, however, this is an easy fix in software.



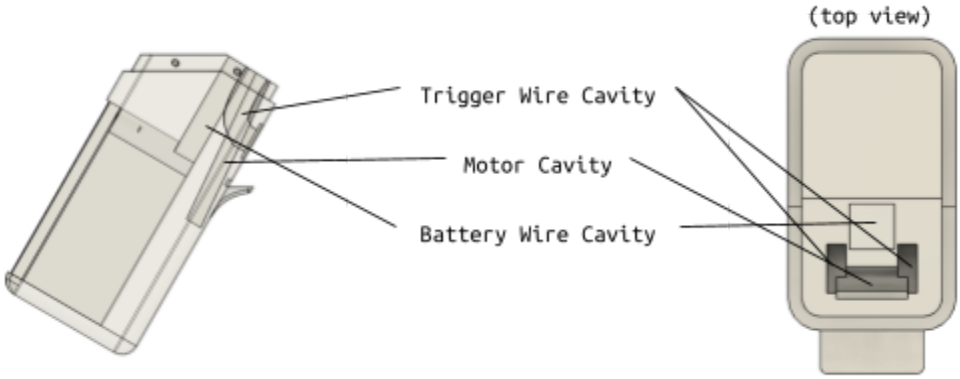
- The switch is placed in the rectangular hold in the back of *center*. Try to ensure that right is on and left is off when wiring.



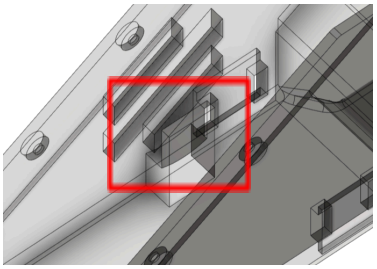
- The battery belongs in the large cavity in the *grip1* part. It attaches to the 9V battery clip, which can reach the cavity through a hole in its roof. I recommend using hot glue to secure the clip's wire in place above the hole so that exchanging the battery later on can't damage the internal electronics.



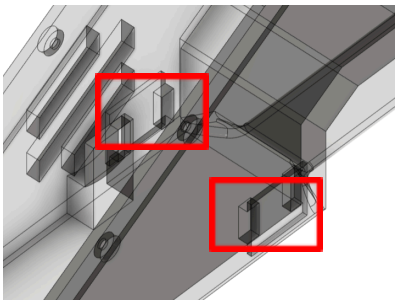
- The vibrating motor disk slides down the long shaft in *grip1* so that it is close to the user's firing hand. It is best to ensure a tight fit or secure it in place with hot glue. DO NOT USE SUPER GLUE; THE MOTOR MAY LOCK UP.



- The speaker clips into the notch on the inside of the *center* piece, adjacent to the holes in the piece's side. The fit should be tight enough that the speaker does not need to be glued.



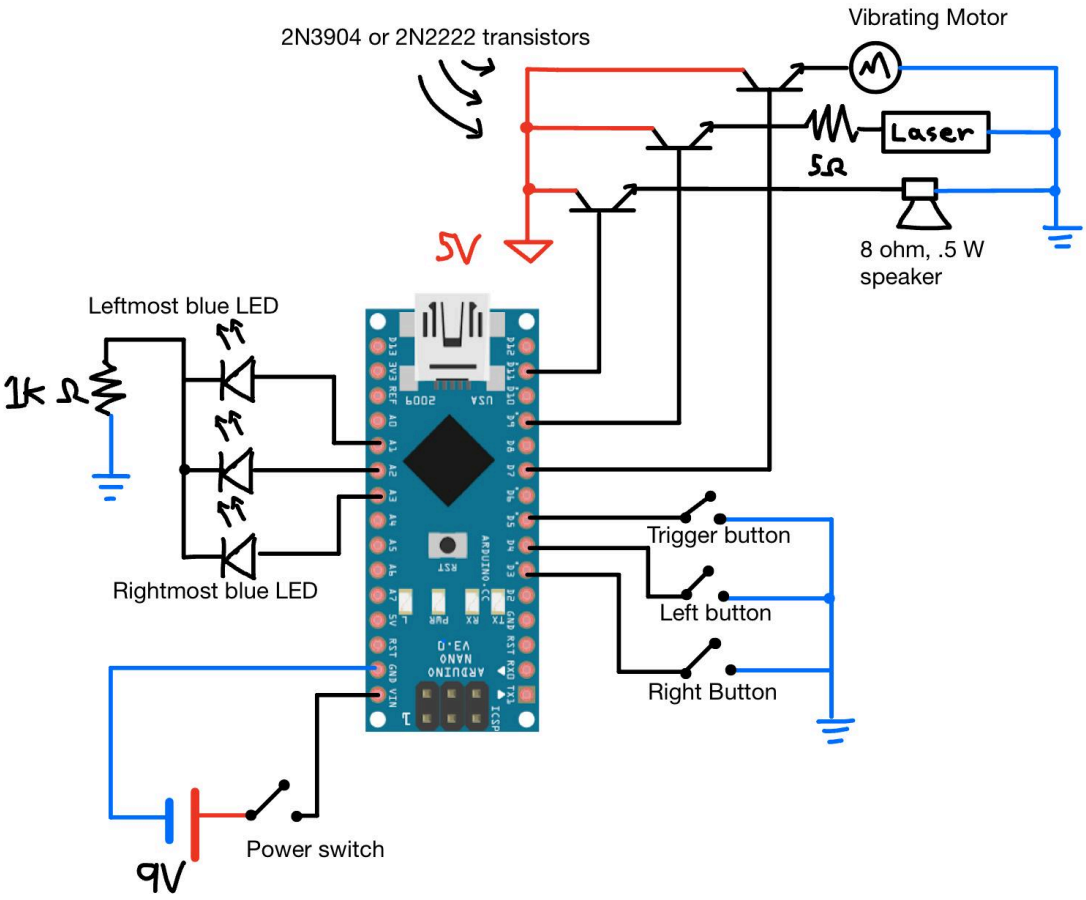
- The buttons are located in appropriately fitted slots on either side of *center* and in the trigger position on *grip1*. There are slots for wires to attach on either side, but you only need to use one. It is recommended that the buttons be super-glued in place, but wait until you are confident in their functionality and positioning, and do not expose the moving parts to the glue.



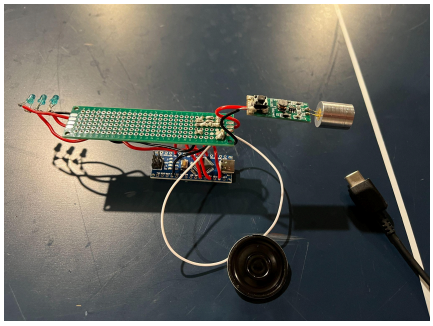
Electronics

This is by far the trickiest part of the project. In order to use the popular Arduino platform while minimizing the size of the blaster, I decided to solder *everything* to the Arduino. It should go without saying to not use an Arduino you plan on reusing should you want to do this.

To connect all components in the proper fashion, reference the schematic below:



Be aware that actually building this requires some planning and a pretty complete knowledge of where all pieces go. Otherwise you may end up with inaccessible parts or wires that don't reach. I recommend soldering most components outside of the blaster, like this:



(Note that the 5 ohm resistance is missing by the laser here. You may not need it, but I strongly recommend it to avoid damaging the laser. Also please ignore my awful soldering.)

I also recommend testing as much as you can along the way.

Some notes:

- The laser module (diode + driver board) must be extracted from the violet laser pointer. Sometimes it may be easiest to crush and/or pull off the plastic cap in front, and then slide the diode out. Other times the extraction may be more involved. Once you have something that looks like this,

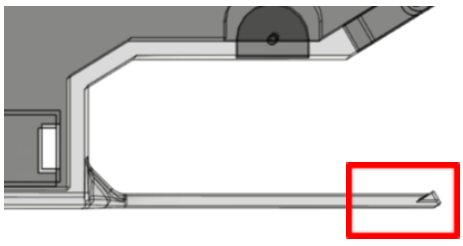
  remove the spring at the end. Additionally, you will need to bypass the push button on the board. To do this, a simple piece of wire connecting opposite leads (ensure they are the correct opposite leads) will suffice.

  When it comes time to solder wires to the laser module, you must find appropriate solder pads on the board. Your ground wire (-) can connect to the pad in the back of the board that the spring was connected to. Your 5V/signal wire (+) will connect to the same pad as one of the three leads coming out of the diode. Use a multimeter to find which prong has zero resistance between it and the aluminum cylinder encasing the diode. In my experience, it is typically the single prong connected to the backside of the board.
- You may want to experiment with the resistance in the LED circuit to find a brightness you like.
- Parts like the buttons and the battery clip should be the last things you solder, since attaching them requires the electronics to be inside (or at least very close to) the printed casing.

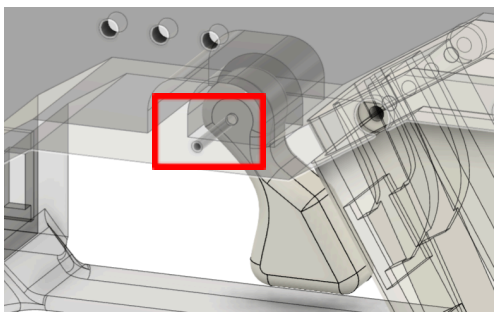
Assembly

Assembly is not very difficult. Most parts fit together intuitively with the M2 screws. The battery gets covered and locked in place by screwing *grip2* on top of the cavity in *grip1*. If The battery does not fit without wobbling around, layers of tape can be applied to the inside of the cavity to make it more narrow or less tall.

On the *center* piece, there is a little ridge where the trigger guard is meant to clip into *grip*. If this ridge will not clip into its designated slot underneath the trigger button, it should be sanded down until it does.



The trigger attaches to the body of the blaster via a paperclip. First, cut a straight piece of paper clip to slightly less than 23.5 mm in length. Then stick it



through the little hole in the *center* piece and the corresponding hole in the trigger as shown here. Ensure the flat side of the trigger is facing the trigger button. Use a small amount of super glue to secure the paper clip in place and to lock the trigger to the button.

Many things will need to be hot-glued in place so that they do not move later on, including the blue LEDs, the Arduino, and the laser. DO NOT USE SUPER GLUE TO SECURE THE ARDUINO – the glue can seep and may damage parts like the USB C port.

To glue the laser in place, apply a small amount of hot glue to the aluminum bulb protruding from the front of the blaster. Then, adjust its positioning so that the laser points in the direction of the blaser's aim. A good way to do this is to place the blaster upside down along the edge of a table and set up a target at one end. Fire the blaster, and ensure that the laser dot appears on the target at an appropriate height above the table and distance from the table's edge.

Targets

Anything glow-in-the-dark works as a target! Matte materials are preferable to avoid reflections. Consider the following options:

Glow-in-the-dark paper:

- Amazon.com : CISinks 5 Sheets A4 Glow In The Dark Rechargeable Photoluminescent Luminous Photo Printing Paper Screen Film, 10-12 Hour 150 Micron for Signs Room Wall Decals Crafts DIY Inkjet Printer 8.27" x 11.7" : Office Products

Glow-in-the-dark vinyl:

- Amazon.com: TECKWRAP Glow in Dark Matte Neon Adhesive Craft Vinyl Precut Sheets 12" x 12" 6 Sheets/Pack for Craft Cutters,Sign Plotters : Arts, Crafts & Sewing
- Amazon.com: AHIJOY Glow in Dark Vinyl Permanent Adhesive 12" x 5FT White to Neon Green Luminous Adhesive Vinyl for Cup Crafts Signs Scrapbook Lettering DIY Projects Home Decor : Arts, Crafts & Sewing

Glow-in-the-dark paint:

- Amazon.com: Rust-Oleum 214945 Glow in The Dark Brush On Paint, Half Pint , Green, 7 Fl Oz (Pack of 1) : Everything Else
- Amazon.com: FolkArt glow in the dark Acrylic paint, 8 oz, Neutral 8 Fl Oz

User Interface

Once you have built the blaster, here is how to use it!

- ON/OFF switch in rear
- Pull the trigger to fire
- Press the left button once to switch modes
- Hold the right button for 1 second (until sound) to reload

- If you are out of ammo, you can also hold the trigger to reload
- Hold the left button for 1 second (until sound) to toggle reloading

The modes cycle through the following order

1. Pistol Mode (semi-auto, 16 shots)
2. AR Mode (slow auto, 30 shots)
3. Burst AR Mode (3 shot bursts, 10 bursts/30 shots total)
4. SMG Mode (fast auto, 30 shots)
5. Silent Pistol (semi-auto, no noise, unlimited shots)