September 2nd - 8 hours. Previous to today, I've spent about 30 hours looking through tutorials and sorting out parts for my board throughout the summer. Today I bought the longboard for $105. I also spent some time looking through the parts I am buying. I had all my electronic parts lined up for purchase, only to find out the company won't ship lipo batteries across the border. I ordered the other electronics from the site and ended up buying two smaller batteries that are equivalent to one big battery for cheaper then it would have costed for the big battery anyways off of amazon. I've also planned out which pulleys and belt I am buying, but I ran out of time today so I will be purchasing them tomorrow.

Some other things I've kinda been debating over is for one, a control system for the board. I was going to go with an rc controller that you hold in your hand, but that is bulky and just asking to be lost. Another option is to have it controlled via Bluetooth from my phone. But Bluetooth can be buggy, and worst case scenario, the longboard does its own thing and flies away at 32 km/h. The final one and the one I think I'm going to go with is a weight sensing board which dictates the speed based on how you shift your weight. The problem with this however, is that I'm not sure how reliable weight detecting sensors are, and they are expensive. There is a thin plastic material called velostat that changes its conductivity based on applied pressure. I will attempt to use this to create very cheap pressure sensing pads. I think while I'm testing the design, I will use the pressure pads but also have a built in fail safe hard wired controller that I hold in my hand. If all goes well, I will use the pressure pads. Otherwise I will just have to live with a controller. In future additions, when cost is no longer a contributing factor, if I still am not able to get functioning pressure pads, a wireless wii nunchuck is also an option for a control system.

September 3rd - 5 hours

Today I bought the final specialty part for my board. The pulleys and belt. I had lined up all the parts I needed to purchase last night, so my plan for today was to simply click purchase. Then I found out that I had miscalculated on the width of one of the pulleys. This really threw a wrench into my plans, and I had to spend a few hours sorting out belt pitch, number of teeth, length of belt and so forth, eventually I settled down on some parts and ordered them from mcmaster carr

September 4th - 1 hour

So today I found out that I messed up. My issue with buying a 5000mAh battery was the price, and I had thought but buying two smaller batteries for cheaper, I had evaded the system. When I combine the two batteries together, either their voltage or their amperage adds together. Unfortunately, after thinking about this, I had gone out and bought two batteries with half the voltage and half the amperage I needed. So when I connect them together, one of the values will still. Be reduced by half. This morning I bought a battery with all the specs I needed for ~$130 plus ~$30 shipping.

September 8 - 4 hours

Today my package from HobbyKing came in the mail. This package included the motor, ESC and battery charger. There was a $20 C.O.D. fee. I’ve been doing some math, and from what I can tell, we’ve gone over budget by quite a bit. The good news however is that the culprit is shipping charges. In my opinion, someone who lives in the states, who is near enough to these companies could get the parts for substantially less or even no shipping fees. One of the companies I ordered parts from (can’t remember which at the moment) actually has free shipping anywhere in the US, but charges $30 to ship to Canada.

Also, I was taking a look at the theorized speed of the board. The motor is a 320 kv motor, meaning it should run 320 RPM per Volt applied. My 6-cell lipo applies 22.2 volts, and so the motor should run 7104 RPM. The pulleys between the motor and the wheel are 14 and 40 teeth respectively, so the wheel should turn at 2486.4 RPM. The wheel has a 70 mm diameter, which is a 219.8 mm circumference. So the board should move at 546510.72 mm per minute, which is 32.8 km/h. 320 kv is the theoretical rating for the motor, without a load. Newtons first law depicts that an object in motion stays in motion. Once the board is up to speed, the force required to accelerate the mass of the rider is no longer needed. And so, once up to speed, the only forces acting against the motor will be friction and wind resistance. One of my goals was to have to board reach 30 km/h, as commercial boards can do anything from 20-35 km/h. With the only load being wind resistance and friction, I believe it will be possible to attain 30 km/h

Later today, I also received my batteries, pulleys and belt. I spent a couple hours drilling the holes through one of the longboard wheels and reading up on how to use to ESC. Tomorrow I'll have to pick.up some nuts and bolts as well as electric connectors.

September 9th - 7 hours

Today i bought the final parts - some screws and electric connectors. I did some wiring and just generally worked on it. I hooked up one of the batteries (11.1v) to the circuit and gave it a test run, just running the motor without any load. It is, well, fast. Really fast. And that’s with only one of the smaller batteries, so only half speed. I feel though that under load it will be slower as the torque is increased.

September 10th - 9 hours

Today I drilled some holes in the trucks for mounting. I also chopped off the protruding ends of the bolts attaching the large pulley to the wheel. I soldered up the connectors for the second small battery, and hooked them up in series into the circuit. I gave the motor a test spin, as well as a spin to the wheel. It’s very, very fast. Granted, the wheel has a very small circumference so the speed is kind of relative, but still, if i fall off and the board continues by itself at full speed, that’s it. With nobody weighing it down, I’m certain this thing would absolutely rocket away, and at 32+ km/h, catching it would be no easy task! Also started designing / printing prototypes of the motor mount. Once the motor mount is finished, I will print a final version at 80% infill. This is the same infill used on my 3d printed ukulele. This should be able to withstand the force required to tension the pulley. After the motor mount is finished, the only thing left to do will be mounting the electronics to the bottom of the board. Once complete, we will be ready for our first test run!

Note: I ordered packages from 5 different places, using four different shipping companies; Purolator, UPS, FedEx and USPS/Canada Post. Purolator, UPS and FedEx all arrived i think within a week or so. They all arrived on the same day after the long weekend. FedEx arrived earlier in the day, with Purolator then UPS arriving later that evening. Lesson learned: Don’t use USPS/Canada Post because they are slow and expensive. My preferred shipping method with most things is FedEx.

September 11th - 9 hours

Much printing, mounting, unmounting, tweaking and reprinting of the motor mount

September 12th - 9 hours

More iterations of motor mount. Printed final version (for now) of motor mount. I used 50% fill instead of 80%. Took it out for a test run. Some of the screws are attached to nylock nuts, but some arent. The ones that bolt the motor to a mounting plate, as well as the one that locks the pulley onto the motor keep shaking loose. Applied Locktite and dremeled a flat side on the motor shaft. Problem seems to be fixed. Motor mount needs some finishing touches, but seems to be working for now. Arduino controller needs reprogramming. I had initial set it to follow the speed of a potentiometer. But sudden acceleration and sudden deceleration causes the belt to slip, or the user to fly off the board.Next iteration of code will only allow the user to tell the board whether they want to accelerate or decelerate. Also, adding a safety cap of 50% throttle through the software, just until I have everything figured out.

September 17th - 3 hours

Have to put the project on hold for the last few days and the next few. One of the batteries I bought was sent to me over-discharged and is now useless (will be leaving a bad review on amazon). I have to wait for my other battery to arrive, which I have apparently been refunded for and automatically ordered a new one… sketchy things are happening with eBay, have to investigate more…

November 6th - 6 hours

Did some redesigning of the motor mount and purchased a new battery as well as a hall effect sensor. The Hall Effect sensor will be use along with a magnet in one of the wheels in order to measure speed. Also built the Velostat foot pedals.

November 7th - 8 hours

Went new iteration of motor mount, printed and tested. Did a bit of test programming with the velostat sensors.

November 8th-November 21st ~10 hours

Been busy lately, had to order parts in mail, been waiting on those. The final version of the motor mount has been printed and appears to be working swimmingly. I’ve decided to name the board “The Sailfish”, aptly named after the fasted fish in the sea. I’ve taken it for a few test rides, it is fast. Very fast. Possibly faster than previously expected. After spraypainting my “Nfish Labs” logo on the board and adding fushia leds, the board has taken on a very beautiful aesthetic. I have decided against using the pressure sensing footpads because a) they ruin the aesthetic and b) they are more of an “off/on switch” rather than an analog sensor. I have decided to use an old android phone I had lying around and use that as the controller via bluetooth. I’ve installed a container on the bottom of the board, as well as mounted the hall effect sensor near the wheel. I ordered some neodynium magnets in the mail, and received them. Interestingly enough, the large pulley attached to the wheel had 3 threaded holes and 3 regular holes for mounting. There are screws in the threaded holes and it just so happens that the regular holes are *exactly* the same size as the magnets. Perfect fit!. I’ve also wired up the leds on the bottom of the board. The only things missing now are the larger battery (which we may or may not receive due to restrictions on ordering LiPos) and a bluetooth chip. Should be reciving the bluetooth chip sometime next week, after that its just a matter of writing some code and I’ll be finally finished.

Presumably, the point of doing this is to learn something, and I’d just like to make a note on what I’ve learned during this experience in the subject of project management. Firstly, and this is not the first time I’ve come to terms with this, when inventing/engineering/designing something, the first iteration is **always** significantly more expensive than the next iterations. During this project, I have bought four different batteries and gone through two different control systems. I’ve prototyped and printed 15 motor mounts. I’ve spent well over 1000$ on this project and nearly half of it is in shipping charges. Second thing I’ve learned, research and planning go hand in hand and are **by far** the most important component of a project. I ended up having to switch control systems because I did not put in enough research on how the Velostat sensors work. The board has a rather chunky and rough start from rest. This is because the motor isn’t able to put in enough torque before reaching a certain speed. The end result is a choppy start followed by smooth sailing. It turns out a possible fix for this is using a motor and ESC with built in sensors. I did not purchase ones with built in sensors because I didn’t even know they existed. Case and point, the more research and planning you put into a project, the better the outcome. Thirdly, when doing electronics projects, either move to Toronto or somewhere in the states. I’ve asked some friends of mine who live in those locations and they can confirm that shipping for all of the parts I’ve purchased is either free or significantly cheaper than what I’ve been paying. For example, the pulleys I got from McMaster Carr, costed me 50$ in shipping (that’s their ~~cheapest~~ only option), to Toronto or most places in the states, it would have been free.

Side note, there are certain areas where I have chosen to spend where I did not need to. The LEDs I mounted on the board costed me 40$. The hall effect sensor and magnet were ~40$ (shipping hurts). These components are by no means necessary to the final product. However, a project like this is only going to happen once. I figure if I’m going to make an electric longboard, I might as well splurge a little.

Dec 9th - 6 hours

And done! Didn’t have a whole lot of time lately, but today i spent the day finishing this project. Yes, it took way longer than expected, and yes I spent way more than expected and technically it's not completely finished but it is done and functions! Included are some pictures of the app and board. In the end, I decided to use an old android phone I had lying around and built an app using the MIT App Inventor program. Basically, the app has three buttons, faster, slower and stop. Faster gets you from rest to a decent speed, then increments from there. Slower increments your speed down, and eventually just brings you down to a stop. Stop, evidently goes from whatever speed down to zero, slowing down at twice the deceleration rate of Slower. There's also a button and menu to connect to the board via bluetooth. I built the app today and did the final update of the code for the board. The bottom line; it works. However, there are things that would need to be fixed either in the future or in a second generation. This project ended up being more of a learning experience than a project. It turns out there are two different types of motors (sensored and non-sensored) and I have the wrong one. Because of this, the board always has a very rocky start from rest. In the future, I would like to use a sensored motor (or two) for a high torque smooth start from rest. Secondly, the battery currently in the board is only half the current and half the voltage I wanted, which means the board has half the range and goes half the speed I would like. That being said, it still goes *really* fast. The new battery, from what I can tell, is lost somewhere in Sweden (thanks eBay). The hardware for the tachometer is built into the board, but is not put into use, it is not necessary for the board to function. The app works, but it could use a bit of optimization as far as safety features go (thinking of adding a killswitch somewhere) and communication with the board, not to mention some graphic designing work. Over all, I am satisfied with this project and have learned a lot. Can’t wait to ride it around next spring!

