# Jan. 14th

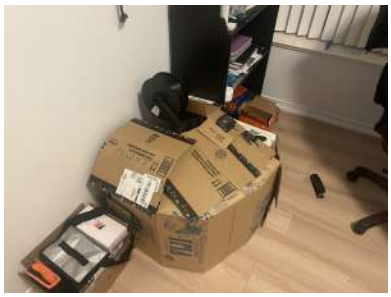
all items have been acquired! listed are

Drone specific mat
- Speedybee F7 V3 Stack
- Lipo battery (6S 1100mAh), charger, bag
- Radio receiver/transmitter
- 4x rotors and motors (1960KV)

Tools and accelssories
- Sets of M3 screws and allen keys
- Soldering kit
- Screwdriver, ruler, caliper, wrench

Printing Plastics
- Black ABS (tested settings)
- Black PETG (not tested settings)
- White, black, tri PLA (tested settings)

CAD
- Rotor guard files with no frame holes (v2)



new ABS enclosure lol jank af made of drink box + 3x amazon boxes

warping & scars on PLA tf man

MOTORS!! little boxes look nice

p.s the m3 bolts were too short so gotta return that to puraltor tmrw

## GOAL: CAD and print drone frame (ABS)

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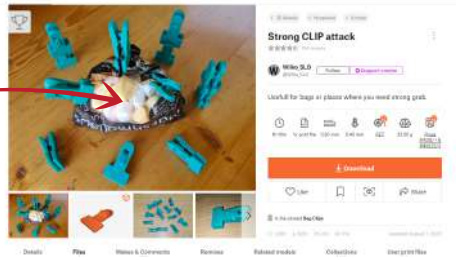
# Jan. 15th/16th

Very sick. But do drone building isn't a work out so I think it's okay.




printing this helping hands model for soldering... don't got alligator clips and don't wanna wrench off the Lipro charger so ig we're printing clips

Still need
- Heat Shrink (grab some from UTRA)
- Voltmeter (pick up tmrw)
- zipties? (can print w PETG, will pick up prob)
- duct tape

## GOAL: Charge lipo, start soldering

printed Black ABS
Remember to switch to purple next time... almost out of this one

# Jan. 17th

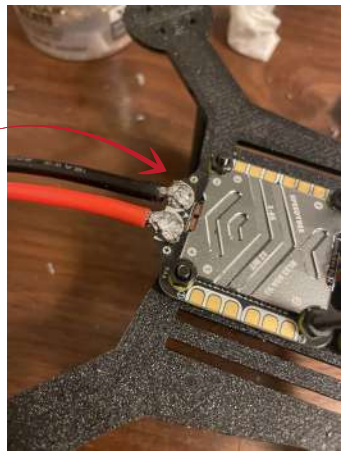
still mega sick ! at least we're making a bit of progress

new printed helping hands work great just like the virus.

rosin and flux paste smoke so much. I hope i keep wearing the gas mask.

FIRST WELD DONE AHHHHH THIS TOOK >3HR

why so patchy?? need to practice soldering but also this wire is huge



takeaways from soldering
- black/dull tip = not hot enough
- tin the tip every once in a while
- temp should be ~450C
- flux paste for adhesion..?

GOAL: FIX THE FIRST SOLDER and start soldering the motors

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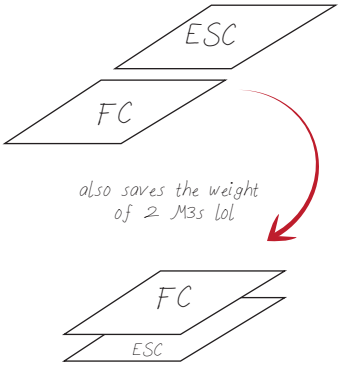
# Jan 18th

Changed the arrangement of the fc/esc stack to as displayed because motor orientations

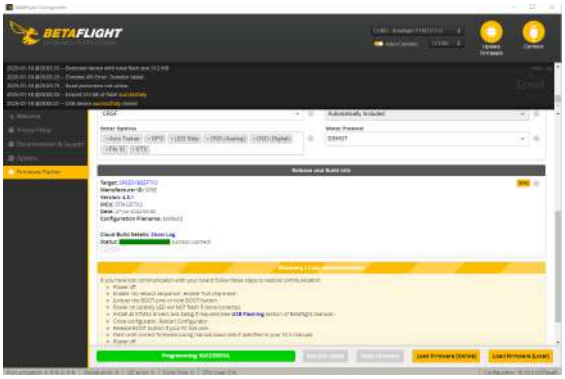



also saves the weight of 2 M3s lol

a pro of using ABS frame: soldering iron can be used to make new holes without reprinting

the silver Sharpie looks really nice ngl

https://youtube.com/shorts/OgQfva7J4UE?feature=share




soldering of motors 4 and 3! testing worked out though after testing one of the (nicer) soldering bits fell off T-T

progression of solder can be seen the rightmost one looks best, though a bit too much solder

## GOAL: Fix old motor solders and connect remainding motors

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## Jan. 20th

New nicer 40/60 solder came in! Will test it next time anything needs to be soldered.

The 4 hour midday nap is new though.

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## Jan. 22th

Finished soldering of motors and strapped down the wires with zipties, attached radio SBus receiver

new soldering w 40/60 is SO MUCH FASTER these were done in like 5 mins

they look kinda ugly but hey it worked.

Tinning and solering practices are much better though!

S / Signal
+ / 5V - Power Pin
- / GND - Ground

don't the antenna look like ears?

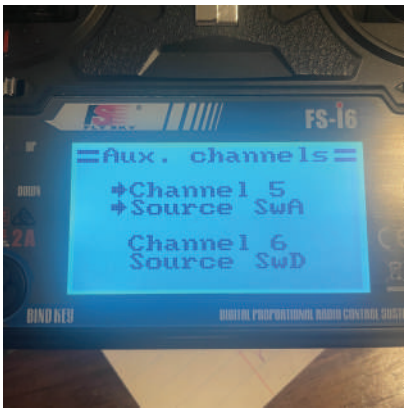
## GOAL: Connect Radio and test transmitter on Betaflight

# Jan. 23th

3 HOURS HAS BEEN WASTED TRYING TO GET THE IBUS RECEIVER TO WORK
but it works now: Betaflight shows the aux bars. The issue was that the iBus protocol apparently had not been updated onto the F7, so it needed to be flashed.

Sleep schedule has suffered :(

Radio Checklist!
- Wired on FC
- Receiver & Controller are connected
- Serial Port (for F7 is UART2) is turned ON
- Radio protocol is set to iBus, firmware is flashed




only two extra AUX channels

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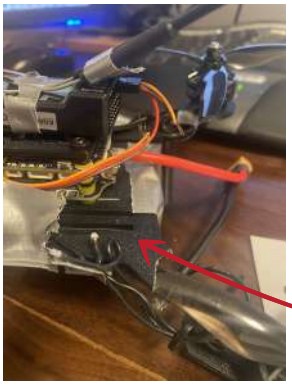
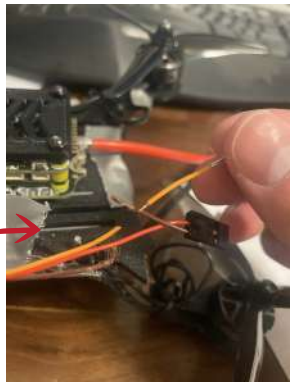
# Jan. 24th 🤡

Nothing was progressed except for the fact that arming apparently blasted the motors so arm 3 snapped off, 2/3 of motor 3's wires got unsoldered, and 2/3 of the radio receiver wires got sliced



rewire motor 3

A chance to upgrade the baseplate i guess...

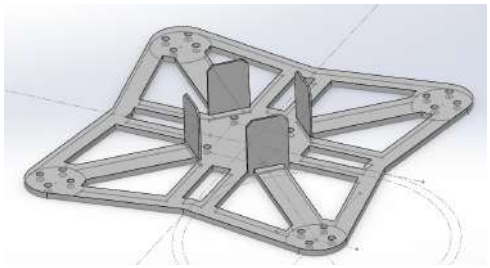


the plan is to:
- strip wire
- solder
- electrical tape
- hope

GOAL: Repair damages, and design/print new ABS baseframe

# Jan. 24th

new frame CADed and printed in purple ABS this time
- Increased main motor arm thickness
- Added + shaped support for motor arms
- Star shaped outline connecting + and x shapes
- Removed legs (just rests on battery now)
- Added 4x guard walls for electronics from rotors



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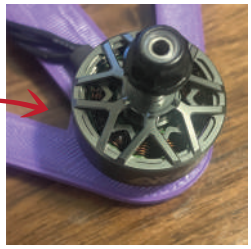
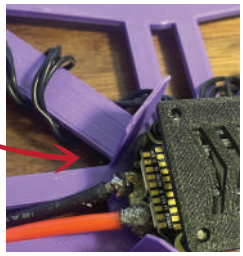
# Feb. 14th 🤡

It's so over.

Motor 4 has been blown out by arming and recklessly throwing up the throttle. Smoke, and the copper wire is now black yay! Reordered set of four motors. Luckily, no fire started though.



Burnt out motor with a side of smoke



Disconnected battery wire with a side of sparks and panic

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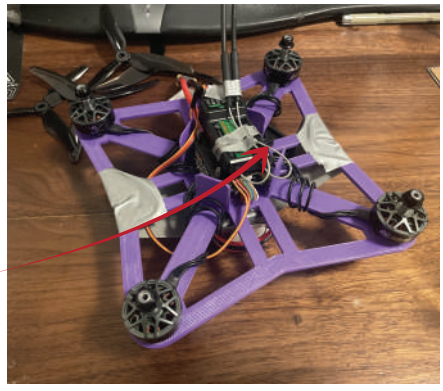
# Feb. 22th

It might not be doomed.

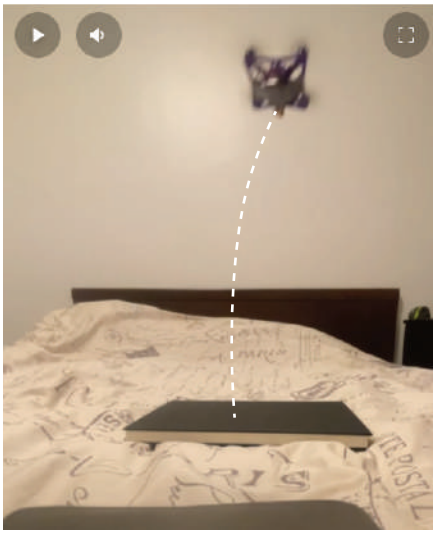
Arming and basic throttle testing with new drone frame.

Additionally, a switch has been installed for battery instead of having to plug and unplug!



https://youtube.com/shorts/9HKPTzjfP8w?feature=share

Basic arming test with lowest throttle input. All sounds good, but next remember to "crank down the props", as some reddit guy said, as the noise from all tests after the first one have a rattling sound, likely from a loose prop.



https://youtube.com/shorts/3Fme7q1HXwI?feature=share

Throttle test went less well... input seemed to work fine, but due to the battery's resting angle, and the fact that ANGLE mode wasn't activated... flight path was not straight. The props have a lot more scratches and scuffs now.

GOAL: Design and print feet for the drone so that it can land and takeoff level to wtv surface

Adjust throttle scaling, since right now, the idle throttle is a bit too strong.

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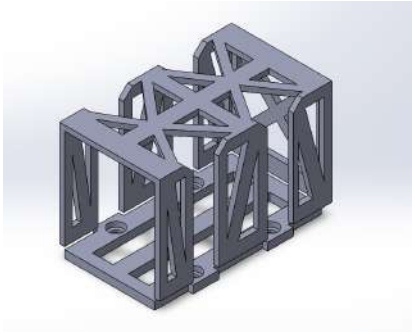
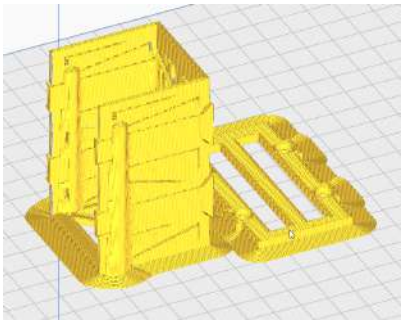
# April 5th

Been a while... ESP is taking its toll but oh well presentation seems to be ready.

Battery cage has been designed and is being printed w white pla pro, which has been calibrated using 'someone's ESP MoS project. Throttle curve has also been adjusted to be max 80%. Idle throttle % remains the same (5% iirc)

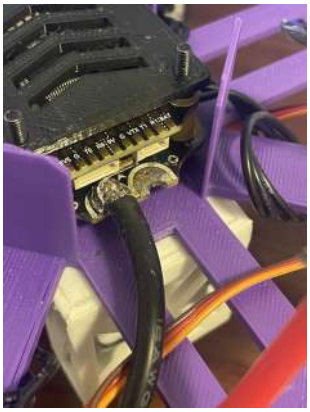
Currently battery cage looks like below, and has many trusses to support zipties for wire. Also, the side cage walls + bottom are printed vertically so that layer adhesion isnt an issue... hopefully that works out :)





# April 7th

Battery box is printed and glue is dried. Battery fits very well in there actually.



Also, stuttoring motors has been figured out... straight up issues with soldering the connector to the esc that was so stupid.

# April 10th

New position setup for radio receiver due to prop noise when spinning up. Below battery cage now. Additionally, green nylon (?) rings are attached between props and nylon nut.

me immediately accidentally turning back and forward and ruining the ring :/

Additionally, I realize i should've done this calculation earlier but here's the simple static thrust calc:

4 x 1300g / motor (at full throttle) = 5.6kg

Therefore, for a good ratio, the craft shouldn't go over 2.5kg likely

https://youtube.com/shorts/mTdX_SYA4Cw

Additionally, testing got this video (on flat ground). There is a small list of things to check/keep in mind from GPT. Mainly that I should get a CF frame T-T

Gyro Noise or Vibration

Especially common if your frame is flexy or your flight controller isn't soft-mounted.
Check the Blackbox (if enabled) or Gyro Graphs (Betaflight Configurator
>> CLI: set debug_mode = gyro_scaled, then watch "debug" in the "Blackbox" tab) for noise spikes.

Fixes:
Add vibration damping to the FC (rubber standoffs or foam).
Balance your props (especially if 3D printed).
Reduce gyro filtering if needed.

Too-High DShot Idle Percent / Minimum Throttle

Betaflight may be spinning your motors faster than needed, amplifying vibrations.
Try lowering motor_idle_percent in CLI:

set dshot_idle_value = 400

Or adjust motor_idle_percent (defaults ~5.5%).

You can try 4.5% and see if the oscillation reduces.

Too-High PID Gains

If your P or D gains are too high, even idle gyroscope noise will cause the PID loop to aggressively react, especially when the quad is still.

Try switching to Profile 2 (defaults) or reducing D gain temporarily to test.

Prop Wash / Air Feedback Loop

If this happens more after throttle-up or while on the ground, it could be air feedback from the ground messing with sensors.

Lift the quad off the ground while still armed and see if it smooths out (without props for safety).

Or test by placing the quad on soft foam or anti-vibration padding.

Motor Desync or ESC Settings

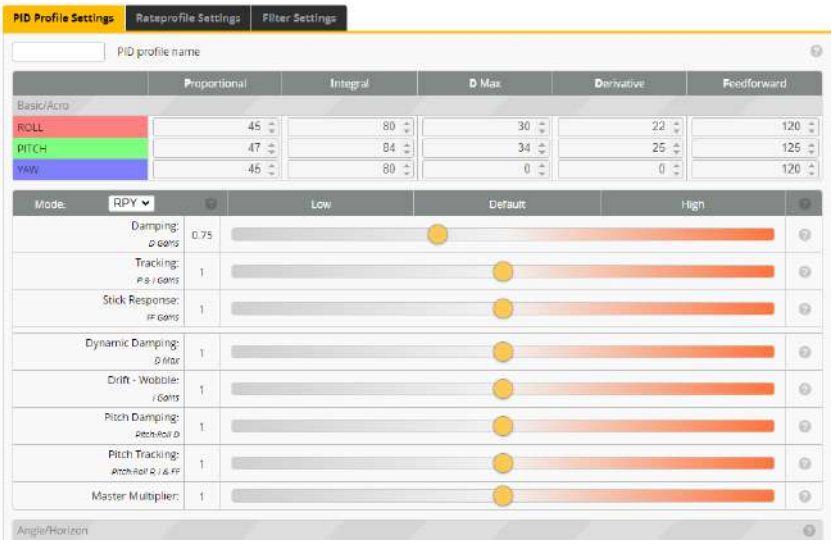
Rare but possible. If using BLHeli_S or _32, make sure motor timing is not too low.

Flash latest firmware and test a higher timing (e.g., medium or high).

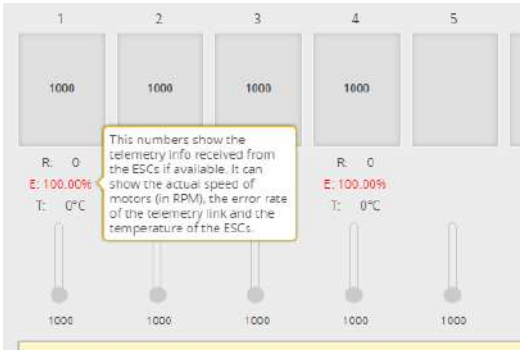
# GOAL: Go through that list and try everything before changing the frame

# April 11th

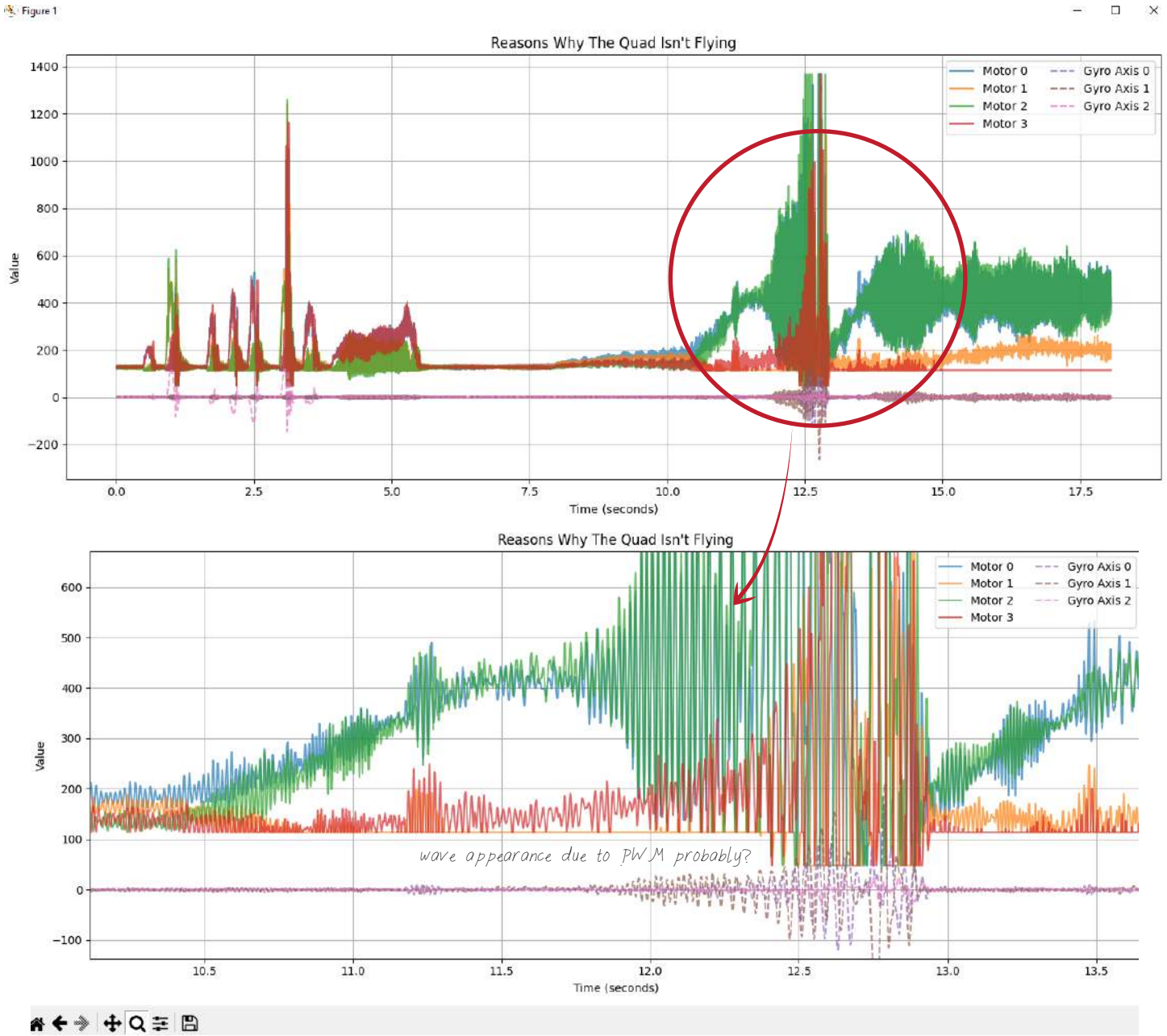
- Changed initial throttle to be 4.6%
- Decreased PR sensitivity by 10%
- Finally activated proper blackbox (GYRO_SCALED)
  Will troubleshoot tomorrow im tired lol




Mildly interesting that the motors tab reads 100% error in bidirectional DShot when motors are all off



Using a bookmarked blackbox viewer with presents from UAV Tech,
Matplotlib, MPLcursor, and Pandas to
make Python visual of motor RPM and Gyros



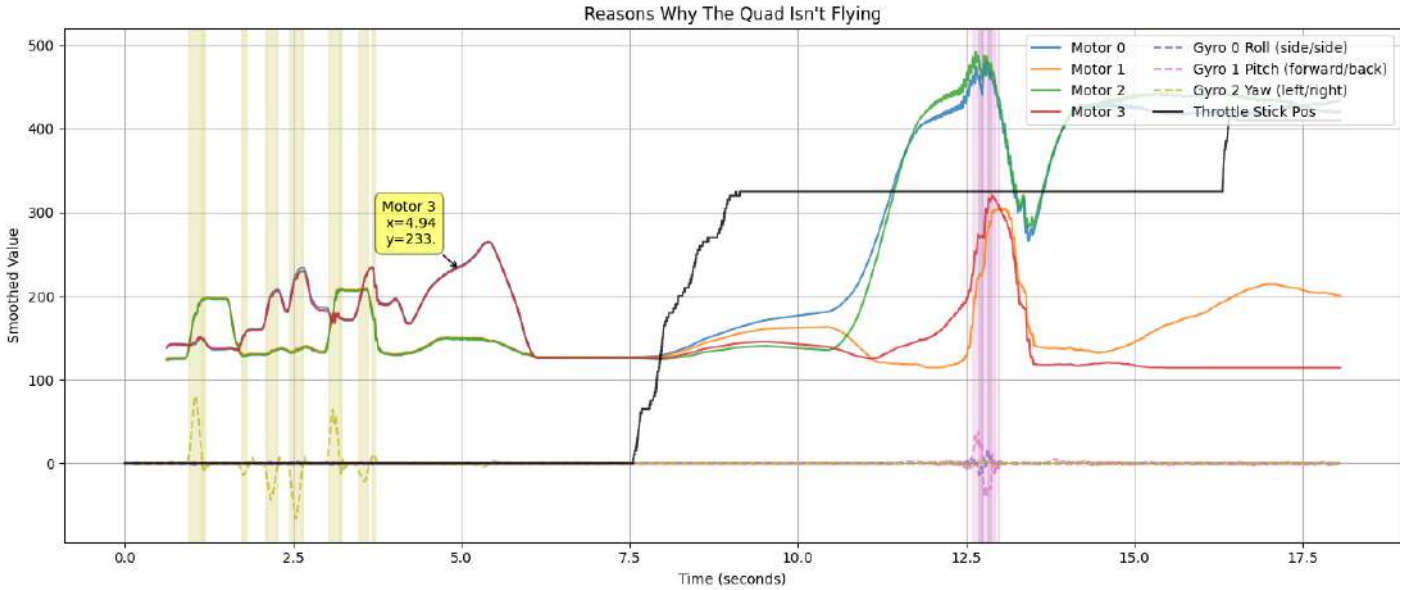

Amazing Motor RPM line :/

Well at least the problem was proved to not just be my hearing

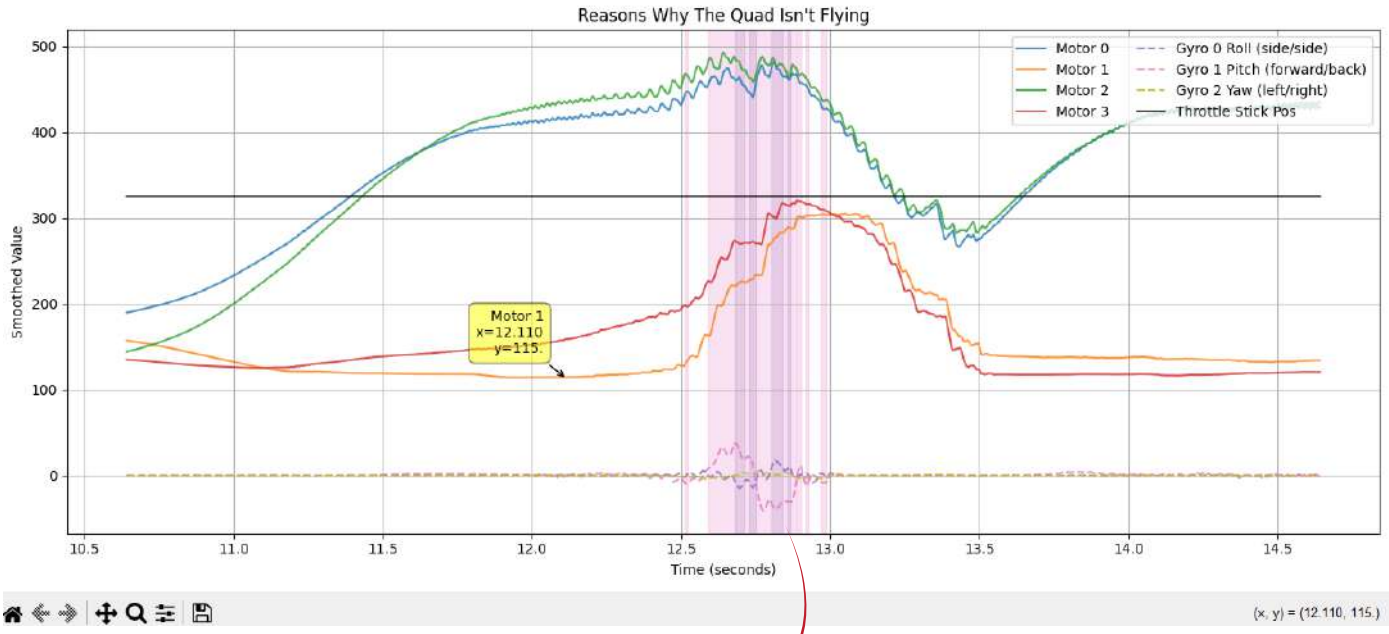
# April 13th

Developed the Python a little bit more (back to CS it is i guess)

- to deal with PWM oscillation used moving window average (gyro's window < motor window)
- Highlgiht gyro extremes in respective colour)
- Renamed gyros to be actual axis intead of just numbers
- Added throttle stick (though I have reason to believe this MAY be inaccurate check transmitter)




Highlighted gyro colours are for > 8rad/s deviation from 0

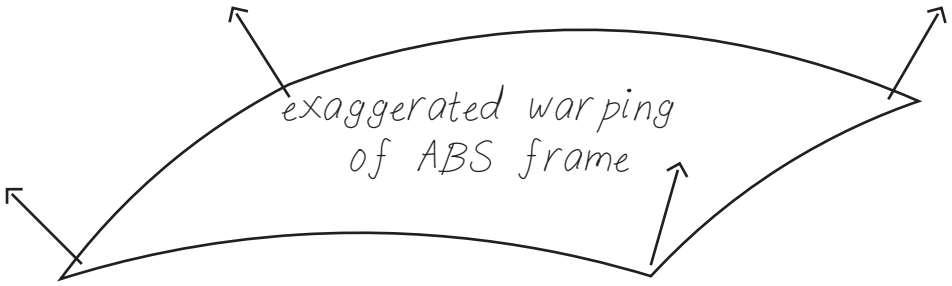



Why is pitch at -40? no idea. to be troubleshooted

# April 16th

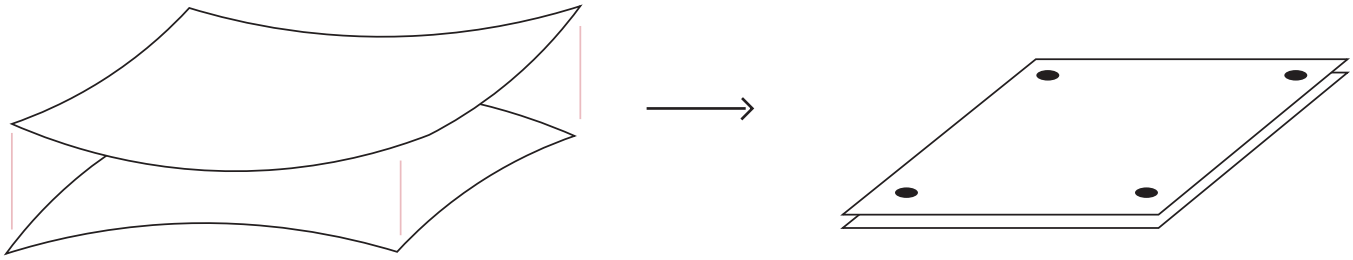
Gyros are reading weird/noisy sometimes. A possible (or small) cause of this could be due to the bowed frame due to (improper) printing.

The frame is warped downwards at corners, likely at different rates so could have caused motors to actually create a bit of RPY




I'll design and grab a CF frame next time UTRA orders, but for now,

Slight redesign of frame.
- multiply height by .6 so that I can print two, then screw together to deal with bowing issue



Does also increase weight for bolts

# May 11th

Been a few days but testing has went well I think enough has been learned from this prototype and a better frame should be pursued

At the current moment, hovering, movement take off and landing are looking good. However, likely due to frame geometry or such, there is a left and backwards drift, which should be fixable with roll and pitch board alignment and/or accel trim.

Drifting

Accelerometer Trim
- directional (+/-)
- Tells ACC that x° is level instead of 0°

Board Alignment
- directional (+/-)
- Assumes FC is not directly flat and changes all raw orientation sensor data

NGL a big part of not lifting off and hovering after all this time might have been just more of my mental thinking the drone is gonna break something.

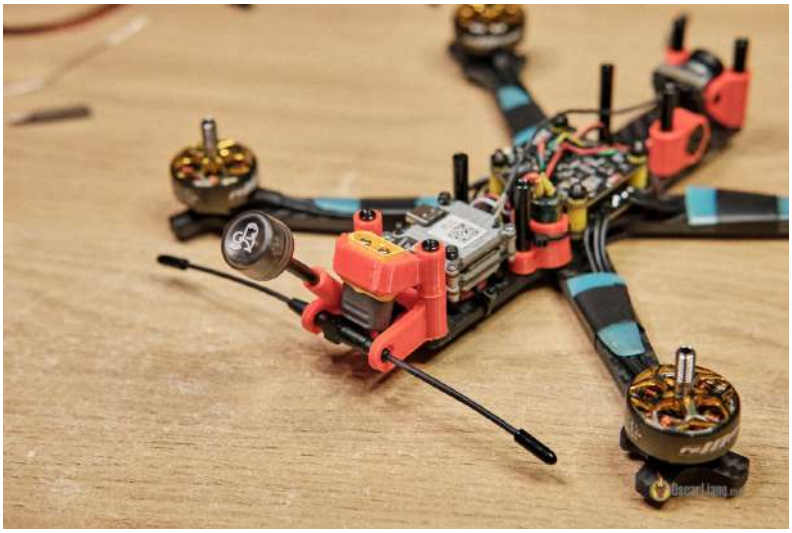
Remember to always check and crank down the props before every flight

https://youtube.com/shorts/IhUnFeFQ7o4

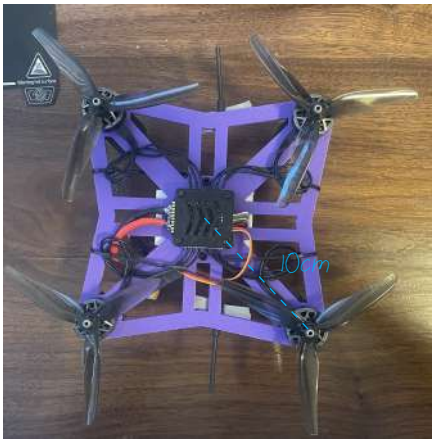
CAD a new frame.

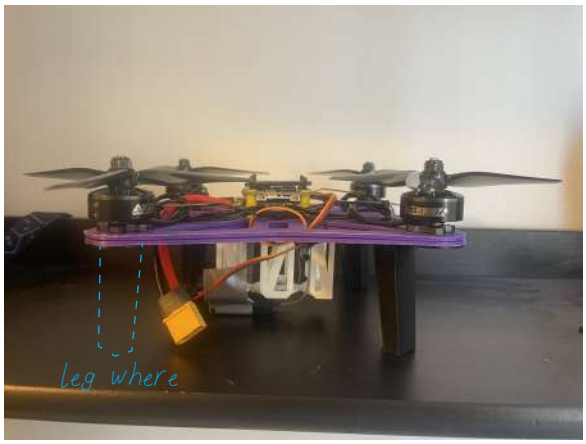
New frame should:

- Battery on top (reduce weight of cage and legs)
- 3D prop arms (to increase stiffness of arms without too much weight)
- Stack XT60 should be fixed in place (to easily power cycle)
- Radio placement should be considered



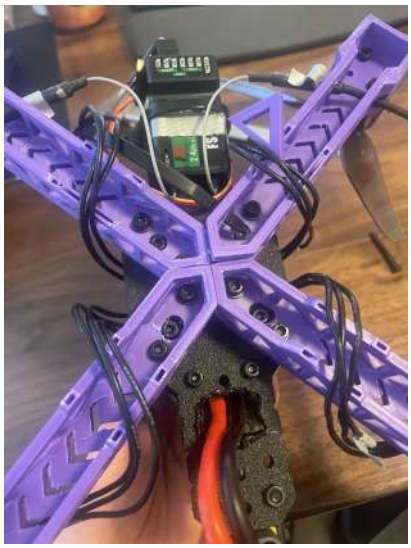
Current State



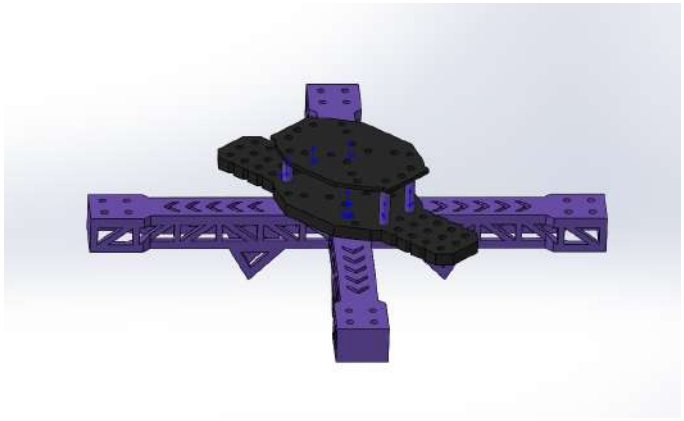



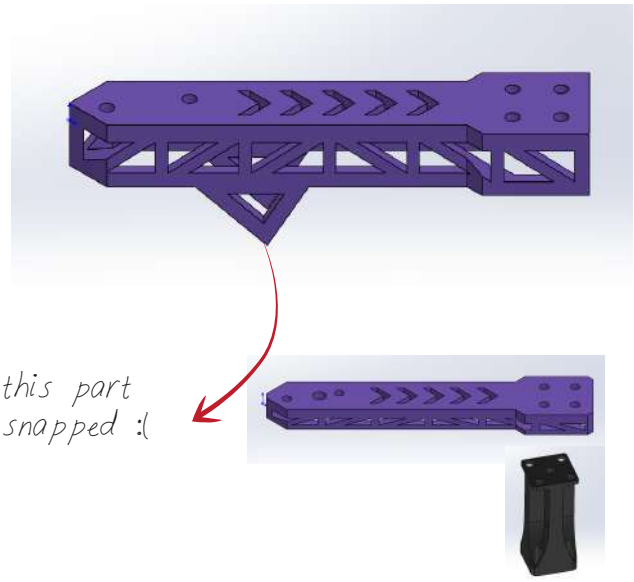
# July 20

Journal was forgotten for quite a bit... previously mentioned new frame was built and already iterated to reduce weight a bit more.



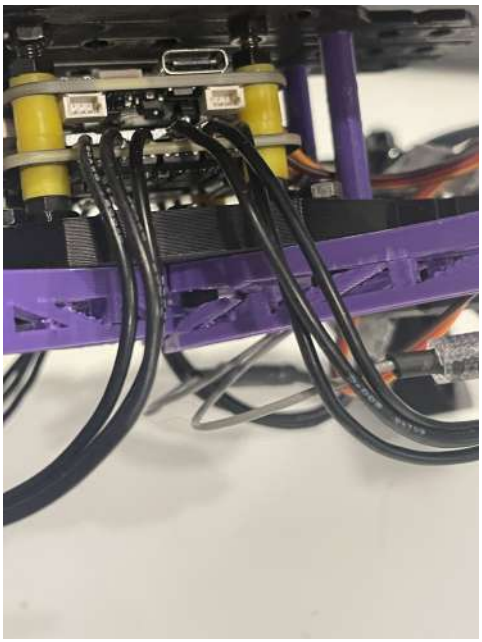
4x arms intead of a single frame since a larger frame wouldn't actually fit onto print bed





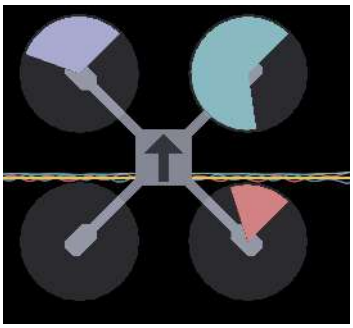

With a failed flight test (throttled up for no reason)
Leg supports were replaced with TPU bits beneath the motors

# July 27



Well I tried to reduce weight by making arms thinner... apparently that introduced Z-axis flex and also might be part of the issue of the gyro misfiring so much

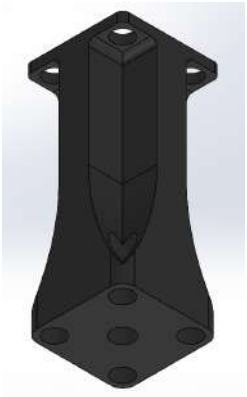
we're back here



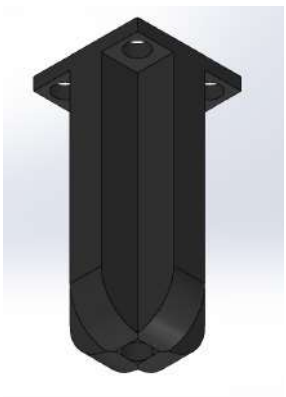
Printer out of commission for now so I will return the arms back to thicker ones :D

# August 8

Even with old (thicker) arms, Arm/ Arm + Angle both still have fluctating motor sounds. tightening the motors and the TPU feet seemed to help, so the feet are redesigned and to be printed with PetG



old



new

Ground contact point is to be round, so that if ground is slightly uneven the drone can still sit even on the ground

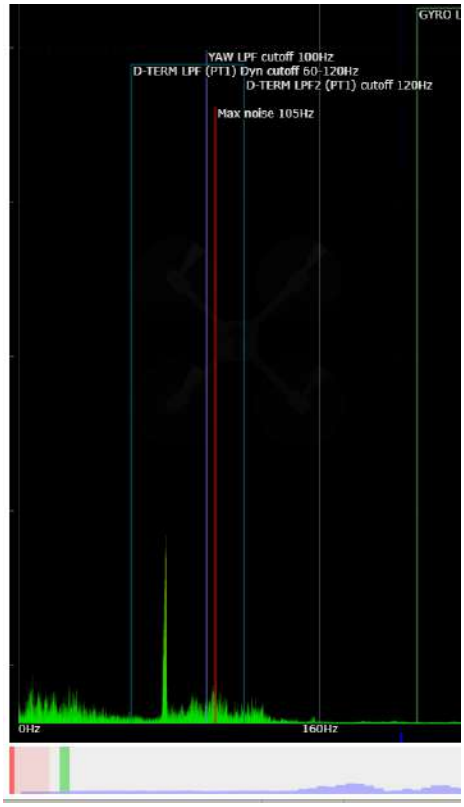
also change to petg to mount the motors on more securely.

# August 19

We're so back. The drone currently flies (unbalanced though), motors no longer overheat, and all landings are bouncy and nothing breaks

https://youtube.com/shorts/XdBB5T2fQrM

Weight spreadsheet is now on drive.




Looking at analyser graph from blackbox log, there is maximum noise at ~105Hz and another spike at 70Hz as well. Used a D notch type filter to just take out noise there

Notes for redesign:
- Feet must be flexy TPU
- Minimize weight as much as possible
- research possible attaching battery to bottom

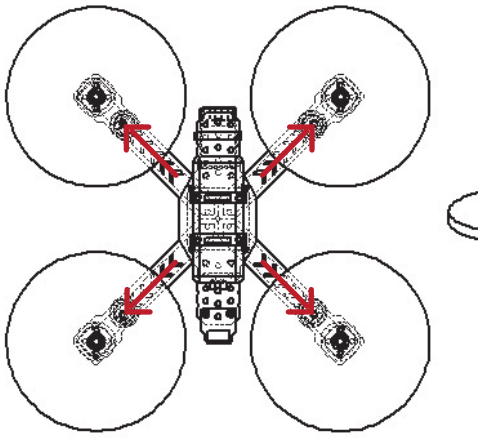
# August 21

New flexible and compliant landing gear/feet have been implemented - segmented TPU fork covering looking thing.

Absorbed shock very well - multiple landing attempts are made and all in success

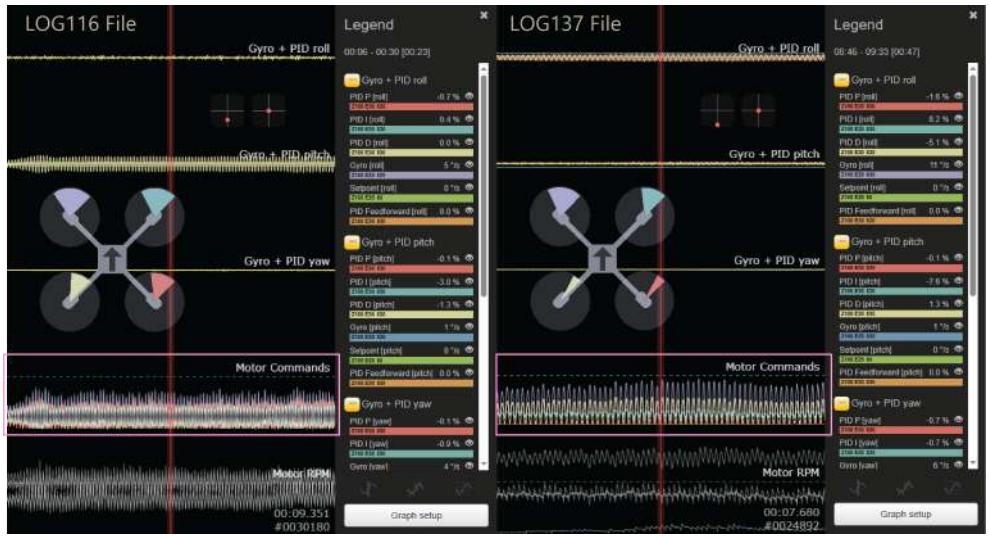
# August 27

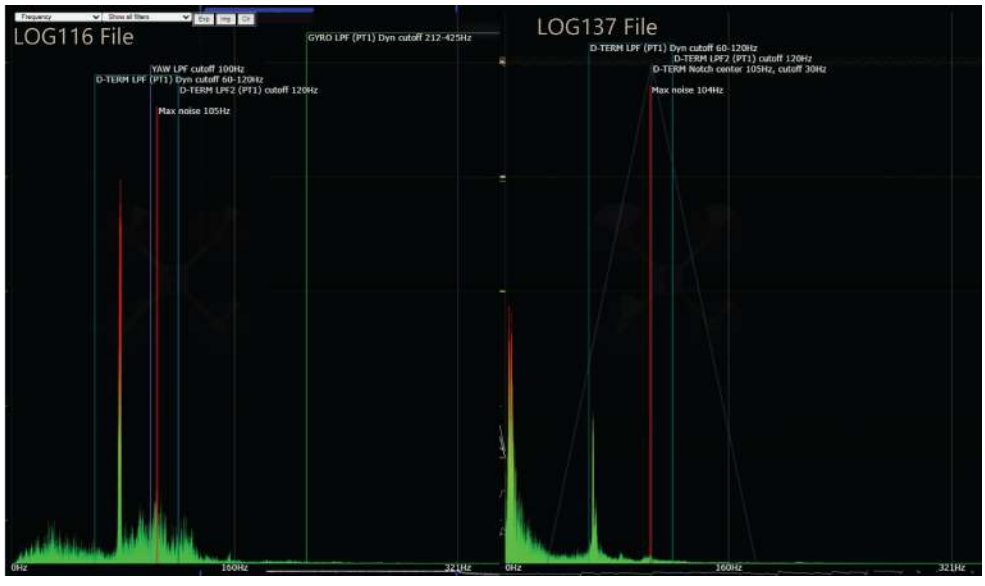
Moved TPU compliant landing legs outwards radially to allow for more stable landings.



New test! Very stable flight (sometimes sways rearwards, but otherwise controls all 3 axis well

https://youtube.com/shorts/cFAZP0LK2D0




Note with new configs
- Motor commands no longer destructively interfering
- gyro telemetry is much more stable
- D-notch filter hits directly on max noise
- Frequency is low-shifted due to dampening from com-