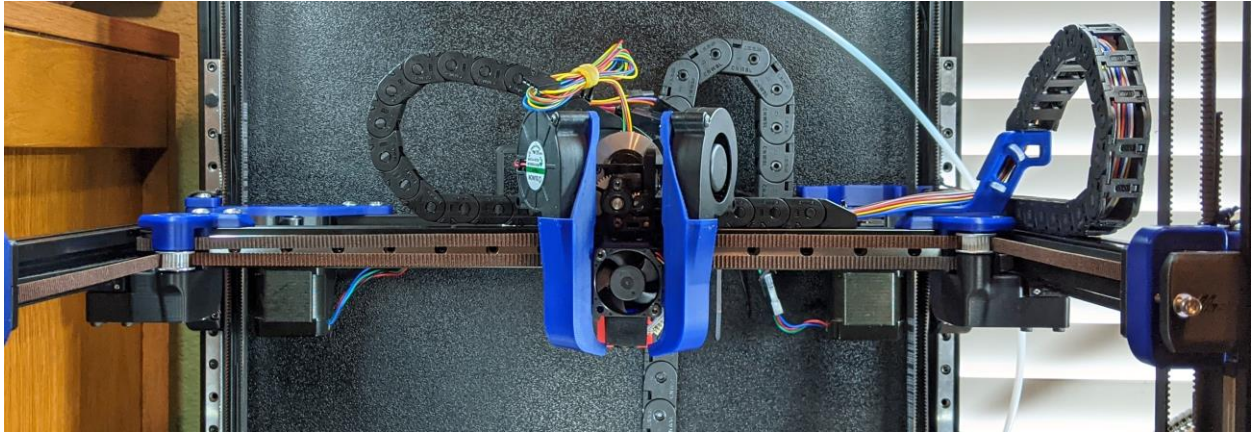


Mantis (Dual 5015 Toolhead) by Long



Features:

- Compatible with MGN12 X-Rail. Dragon Hotend only right now.
- Dual 5015
 - Left to Right airflow balance is no longer an issue
 - Single piece ducts without splitting and fewer bends mean less losses
 - Total airflow is probably ~3x more than Longs fang using the same fan.
- Lighter
 - This entire tool head weighs ~290g including the carriage
 - Spec AB is ~470g. Spec AB with gailieo is ~375g.
- Stiffer
 - Single piece carriage and hotend mounts are significantly stiffer than spec.
- Detachable Bed Probe (magprobe)
 - Decreases weight and allows shrinkage of the carriage.
 - Allows direct probing of the bed surface. Allows usage of any bed surface.
 - Bed with embedded magnets becomes a possibility.
- More balanced
 - Hotend is moved closer the rail +y, and upwards +z
 - Gain in Y and Z travel (~5mm each)
- Decreased length from extruder to hotend
 - Bowden from mini-sherpa to Dragon is only 19mm
- X-endstop relocated to carriage. Easy to transition to umbilical if desired.
 - Y-endstop can still be from the spec endstop pod on the right xy-joint.
- Area around heat block is very open. Ducts give wide berth to block. Duct shouldn't have any issues with melting. Josh Murrah has been printing ABS at 300c without duct melt.

Cons:

- You will lose some space at the front idlers ~10mm in X at each idler.
 - Make sure you change your homing override to home Y first, then X.
- Some parts like the ducts and hotend mount are a bit tricky to print.
- Thumb screw for the mini-sherpa will not fit. Use a buttonhead to save space.
 - I bought 6mm diameter x 0.9mm coil diameter x 10mm length springs for extra clearance.
 - (Replaces stock 6mm x 1mm x 12mm spring)
 - Depending on how much you tighten your screw, the 12mm one will work.

BOM, References, Acknowledgements:

- **Fasteners**

- m2 x 10 (or m2 x 12) self tapping screws
 - This is a standard Voron part used to attach the Omron microswitches
- m3x6x4 heatsets
- m3x20 SHCS x2 (upper screws to attach hotend mount to carriage)
- Assorted BHCS (all other screws can be button head to save weight)

- **Other**

- m6x3 magnets x11
- larger magnet stack (used if soldering directly to the m6x3 magnets) so that magnetic field loss is minimized during soldering)
- D2F-5 Omron microswitch for magprobe. D2F-5L works too if you just rip the lever off.

- **Fans**

- 5015 fans x2
 - I recommend Sunon (12v) or Delta (24v) however any 5015s should be fine.
 - Sunon: <https://www.digikey.com/short/zrwpw9>
 - Delta>Sunon>GDSTime>Winsinn
- 3010 Hotend Fan
 - I'm using Sunon 3010v1 (12v) currently <https://www.digikey.com/short/t5dpqw4w>
 - I think the Sunon 3010v2 (12v) will work as a quieter option, but haven't tested yet <https://www.mouser.com/ProductDetail/Sunon/MF30101V2-1000U-A99?qs=EU6FO9ffTwfZ4Kz3LWY0zg%3D%3D>

- **Mini-Sherpa**

- See the Annex guide for its instructions and BOM.
- https://github.com/Annex-Engineering/Sherpa_Mini-Extruder
- <https://www.youtube.com/watch?v=3WogD5IUwAM>

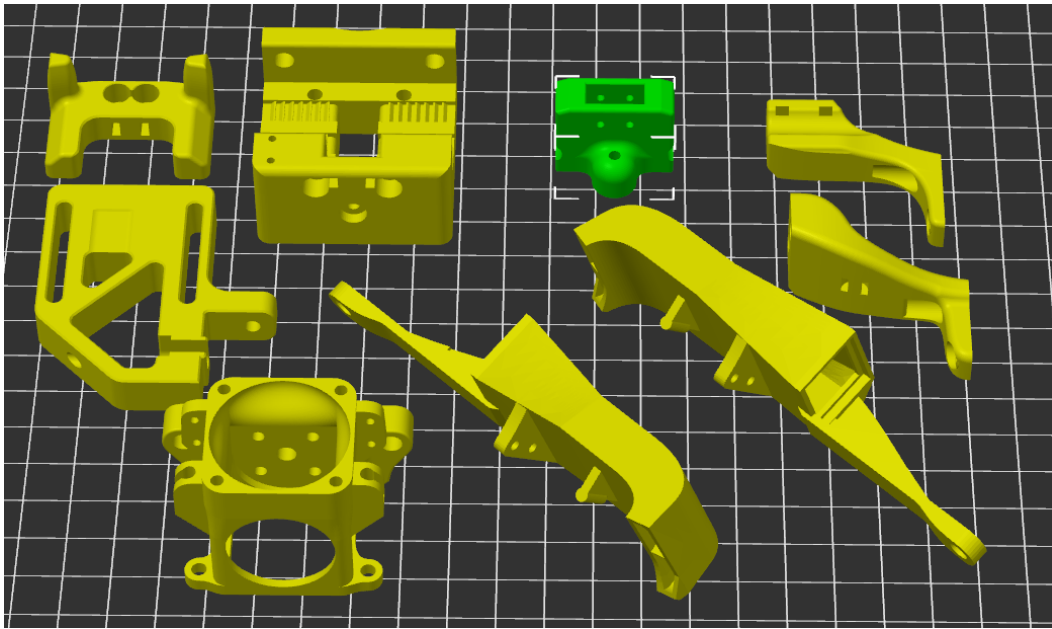
- **Mag Probe**

- My version is highly inspired by the Annex Mag Probe. ***Credit to ANNEX for their awesome work here.*** The mag probe and being able to remove the bulk of the Omron probe is a major factor in what made this tool head possible. Please see their mag probe repository for the original.
- https://github.com/Annex-Engineering/Annex-Engineering_Other_Printer_Mods/tree/master/All_Printers/Microswitch_Probe

- **JoshMurrah**

- Just wanted to note him here as he has been extremely helpful in some insane stress testing. His speed benchies have been fun as hell to watch and a motivation for me to keep improving.

Print Orientation:



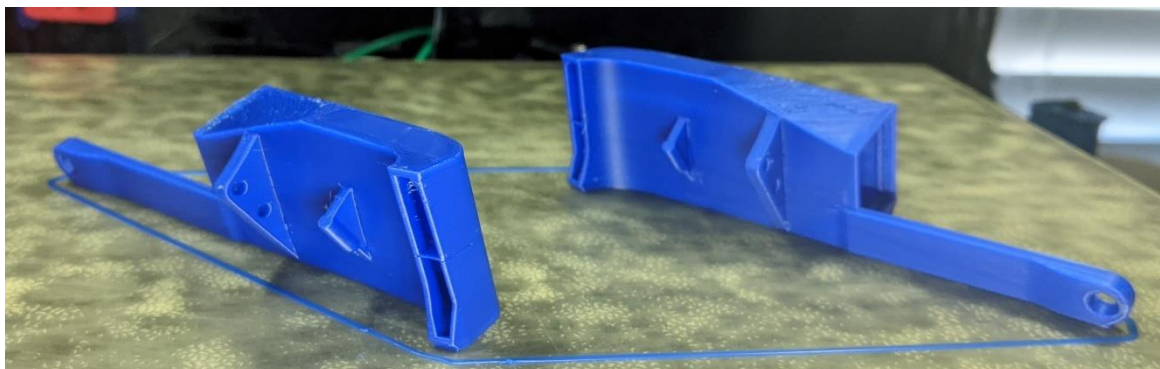
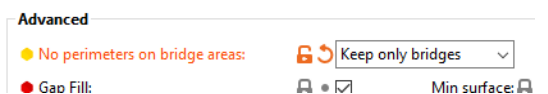
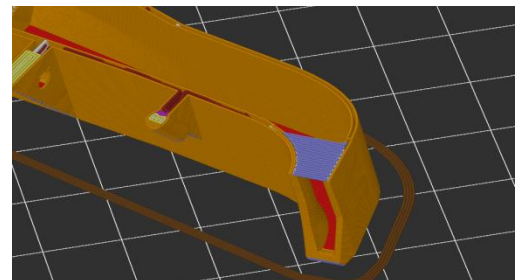
Slicer Tips:

- **Perimeters/Shells**

- 3-4 Perimeters and low infill is adequate.
- Josh Murrah is using 3perim/40% on his toolhead used in speedruns.
- I've been using 4 perimeters/15%

- **Ducts**

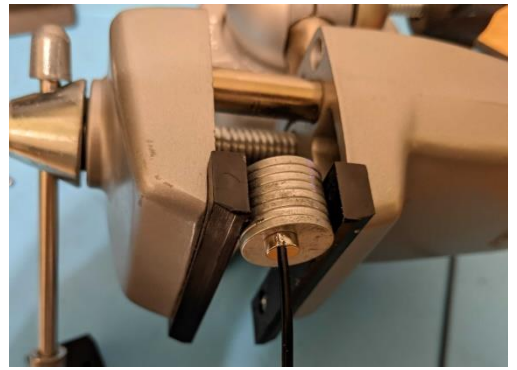
- Check that this outlet divider is sliced in a sane way.
- In superslicer, I find the "keep only bridges" option under "Perimeters & Shell" works well for the ducts
- The ducts have some tough overhangs, so orient the part so the overhangs print the best for you. Prioritize good quality for the outlet. The 5015 mount surface will generally be rough, but that's ok.



Carriage Assembly:

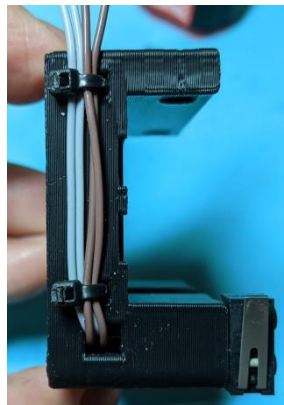
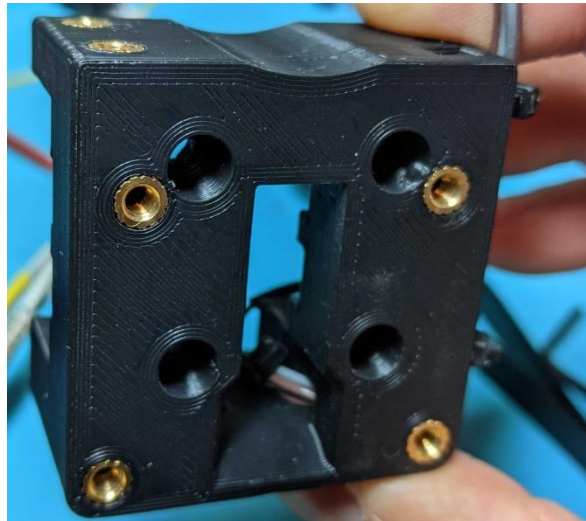
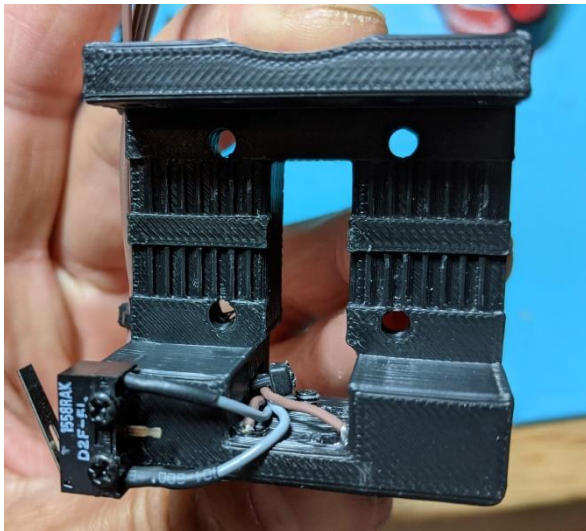
Magnets

- **Solder Method**
 - Sand the side of 4 m6x3 magnets. Place a magnet on a bigger stack of magnets then solder a piece of wire to the side as shown.
 - If you don't have the magnet on the bigger stack, your magnet will lose some of its magnetic field. It'll probably be ok, but I haven't tried.
- **Wire Pinch**
 - Josh Murrah was able to attach his magnets by fanning out the wire then compressing the wire between the carriage and magnet and gluing in place. This method appears to be working fine for him.
 - The carriage uses 2 stacks of 2 magnets and a m3x6 button head
 - Adjust the tilt of your magprobe by screwing in and out the button head screw
- **USE GLUE IN THE CARRIAGE PRIOR TO PRESSING IN THE MAGNETS**



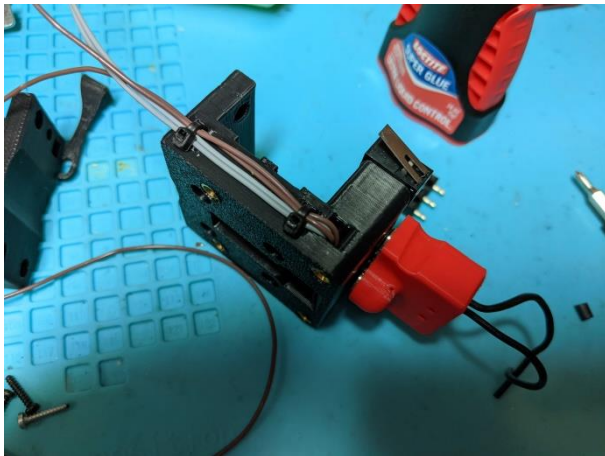
Heatsets

- As shown on front and top. There will be an extra hole. This is an extra hole in case something else needs to be mounted (power distribution or something) later.



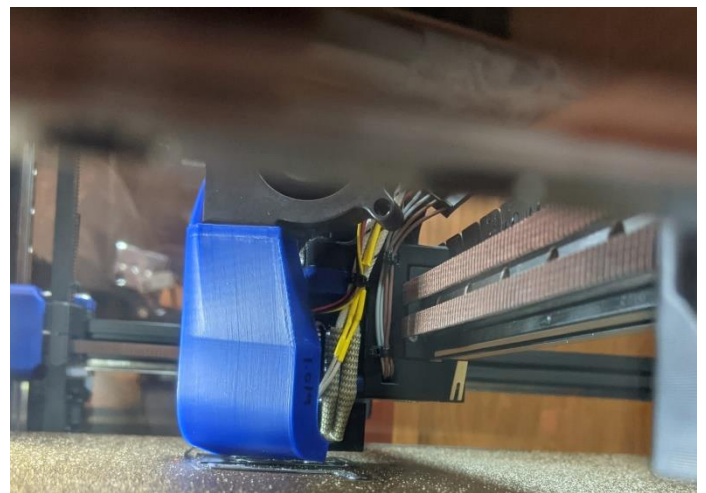
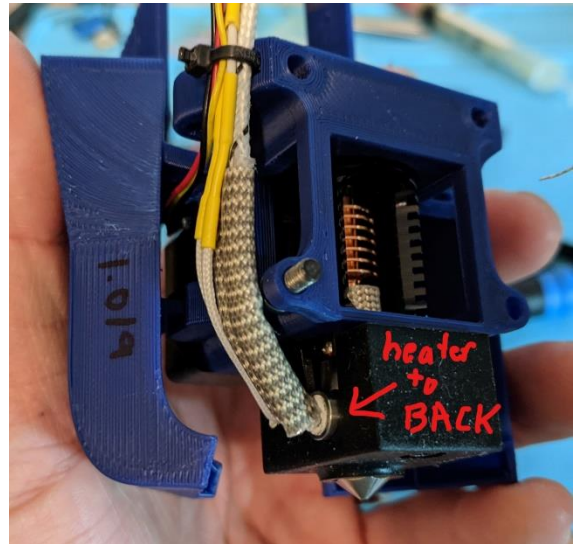
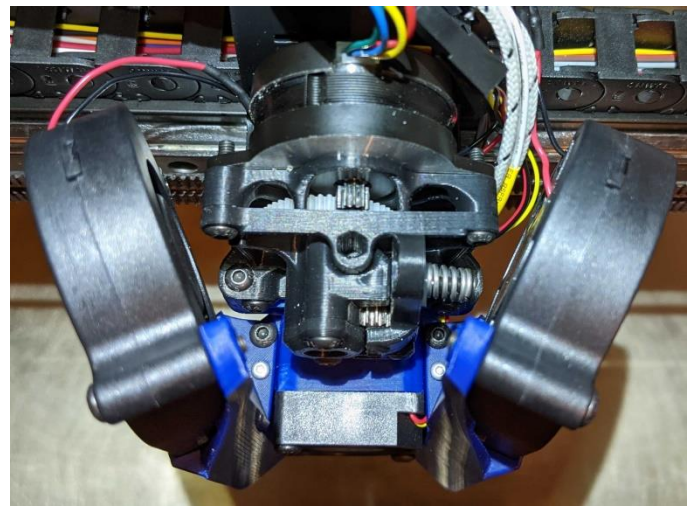
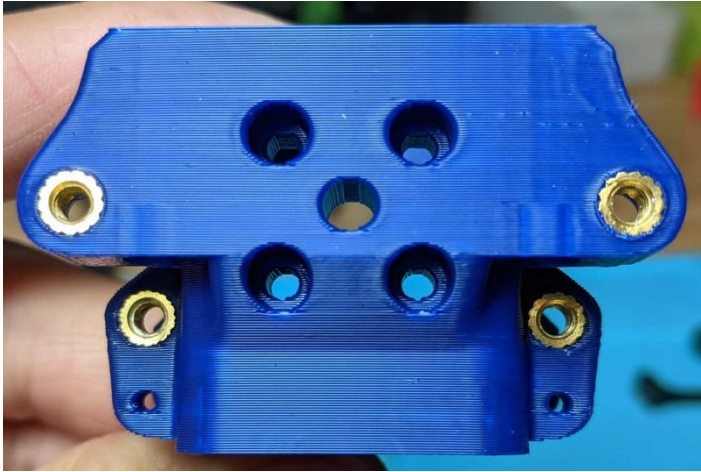
Mag Probe:

- Solder a short length of flexible wire to two m6x3 magnets then press the magnets into the holes.
- Alternatively, fan out the wire and press/glue in the magnets.
- When pressing in the magnets, I used a clamp and a flat surface to try to get the magnets flat.
- Screw in two of the m2x10 or m2x12 self tapping screws (silver ones on the red magprobe) prior to soldering the microswitch in. Take care not to damage the wires.
- Solder the other ends of the wires to the **outer prongs (NC)** of the D2F-5 microswitch. Note the image with the black magprobe is an older version.
- Press in the D2F-5 microswitch now and screw in two more m2x10 or m2x12 to secure the microswitch. If there is any play in the microswitch, use some superglue to remove the play.
- Test fit the magprobe to the carriage and adjust the level of the probe using the m3 button head on the bottom of the carriage.
- Insert magnets into dock arms and secure to bed extrusion.
- You don't have to remove your bat85 diode when wiring in the wires to the magnets on the carriage
- Video of docking and undocking. Build your own macros or see annex engineering for their macros.
 - <https://youtu.be/hdD8uaDW-pA>



Final Assembly:

- Use button heads for everything if possible.
- ****note the heater cartridge location****















Firmware Settings:

- With my Sunon I have been able to pwm down to 7% using these settings
 - kick_start_time: 0.5
 - ## Depending on your fan, you may need to increase this value
 - ## if your fan will not start
 - off_below: 0.05
 - cycle_time: 0.008

Slicer settings:

- This is currently what I've been using for ABS as far as cooling.

Fan speed - default

| | | |
|---|---|---------------------------------------|
|  Run the fan at default speed when possible: |  | <input checked="" type="checkbox"/> |
|  Default fan speed: |  | <input type="text" value="10"/> % |
|  Bridges fan speed: |  | <input type="text" value="35"/> % |
|  Top fan speed: |  | <input type="text" value="-1"/> % |
|  External perimeter fan speed: |  | <input type="text" value="-1"/> % |
|  Disable fan for the first: |  | <input type="text" value="1"/> layers |

Short layer time - began to increase base fan speed

| | | |
|--|---|---|
|  Enable fan if layer print time is below: |  | <input type="text" value="45"/> approximate seconds |
|  Max fan speed: |  | <input type="text" value="50"/> % |

Very short layer time - began to decrease extrusion rate

| | | |
|--|---|---|
|  Layer time goal: |  | <input type="text" value="15"/> approximate seconds |
|  Max speed reduction: |  | <input type="text" value="90"/> % |
|  Min print speed: |  | <input type="text" value="20"/> mm/s |

Behavior

Fan will run at 10% by default, at 35% over bridges, except for the first layer where the fan is disabled.

If estimated layer time is below ~45s, but still greater than ~15s, fan will run at a proportionally increasing speed between 10% and 50%, at 35% over bridges if it's above the current computed fan speed value ; except for the first layer where the fan is disabled.

If estimated layer time is below ~15s fan will run by default to 50% (except for the first layer where the fan is disabled) and print speed will be reduced so that no less than 15s are spent on that layer (however, speed will never be reduced below 20mm/s or up to 90% reduction)