

# Open Source - Very Big Stick MKII

## MECHANICAL BUILD GUIDE

**REVISED Beta v1.3**

2024-04-10



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## Build Guide Videos

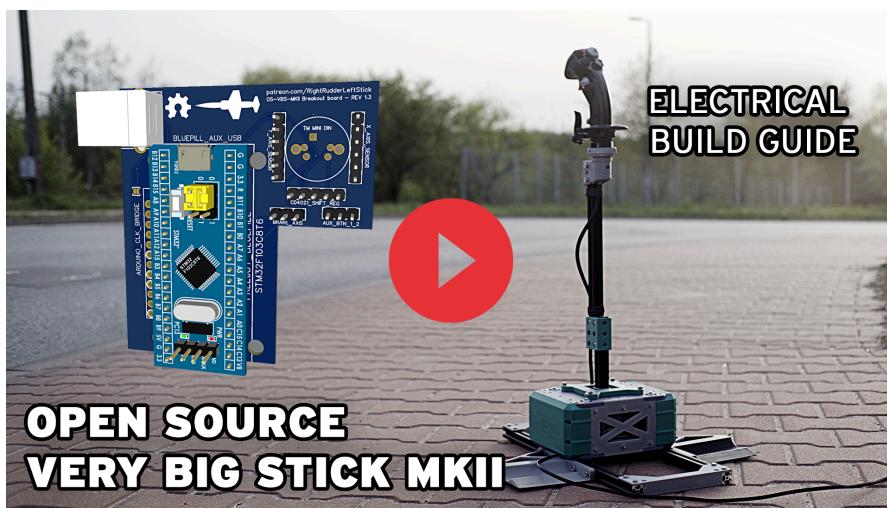
Instructions on how to assemble the OS\_VBS MKII gimbal is available on rightrudderleftstick's youtube channel. Please watch and follow carefully on how to assemble these components.



You can watch the video at this URL:

<https://www.youtube.com/watch?v=IdYbF5dOYag>

The Electrical build guide, as well as the office chair mount is available on this video.



You can watch the video at this URL:

<https://youtu.be/jo0v6YuI9vU>



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## Bill of Materials

This is a live link to a spreadsheet containing the bill of materials for hardware and parts to be printed.

Part name	Quantity	Thicker walls required?	grams each	Total grams	Optional?
<b>PRIMARY GIMBAL</b>					
PitchFrame_TopPlate.3mf	2	n	118	236	
PitchFrame_SidePlate.3mf	2	n	47	94	
Cam_rollerSpacer.3mf	2	n	1	2	
<del>Cam_bearing_washer (No longer needed with new cams)</del>	4	n	θ	θ	OBSOLETE
MainSleeve.3mf	1	y	54	54	
PitchFrame_PillowBlock.3mf	2	y	90	180	
RollFrame_PitchPin_Gear.3mf	1	y	43	43	
RollFrame_PitchPin_Camside.3mf	1	y	46	46	
RollFrame_GearSide.3mf	1	y	49	49	
RollFrame_CamSide.3mf	1	y	49	49	
M12_WasherSpacer.3mf	2	n	2	4	Y
SOFT_CAM.3mf (MED or HARD)	4	y	23	92	
TLE5011_frame.3mf	2	n	2	4	
TOTAL Filament PETG				849	grams

### TM Grip attachment with Offset

TM_VIRPIL_ADAPTER_OFFSET.3mf	1	y	50	50	
MINI_DIN_Holder.3mf	2	n	1	2	

### Optional Add-ons

OuterCamCover_Solid.3mf	2	y	109	218	
2020_CYC_OFFSET.3mf	1	y	36	36	Y
Cyclic_RestrictorPlate_20degrees.3mf	1	y	40	40	
ASSY_USBCABLE_STRAIN_RELIEF.3mf	1	y	1	1	

### Chair Base Add-on

2020_Crossbar.3mf	2	y	57	114	
CHAIR_WHEELCHOCK.3mf	1	y	100	100	



CHAIR_WHEELCHOCK_Mirror.3mf	1	y	100	100	
TOTAL Filament PETG				<b>661</b>	grams

PRIMARY HARDWARE		Notes			
1KG PETG 1.75mm filament	1	PLA+ untested. Do not print the CAMs in PLA as they will distort over time.			
2020 v slot aluminum rod - Cut to length	1	Length depends on your choices			
608 bearings	12				
6003 bearings	4				
18x24.7x1 Teflon Washers	4	<a href="https://www.aliexpress.com/item/4000935512060.html">https://www.aliexpress.com/item/4000935512060.html</a>		Y	
M3x8mm	8	Do not use countersunk heads, 4 are for mounting the TLE5011 sensors			
M4x20mm Socket head	20				
M5 vslot drop in nuts	11				
M5x8mm Socket Head	10	6 less if TM adapter is not used			
M5x16mm Socket head	2	Put into the middle of the camside 6003 bearings for extra strength		Y	
M5x50mm	2	For the counterweights		Y	
M8 washers	4				
M8 Spring Lock washer	6				
M8 Nylon Lock nuts	8				
M8x35mm HEX Head	3	Must be hex head for clearance			
M8x50mm socket head	3	Two of them must be Socket Headed			
M8x80mm HEX or Socket Head	2				
M8x100mm HEX head	4	HEX head only			
M12 Washers	20	For counterweights		Y	
FRT-C2-301-G1 Rotary damper	2	Make sure to get the kind that dampens both directions!		Y	
Extension spring with loop ends. ~60mm unloaded	2	I used this mcmaster part in the design (3630n293), untested! You'll want to test many springs			
Extension spring with loop ends. various lengths	2	This is the second set of side springs, try several to tweak		Y	
M3x6mm standoffs	4	They come with the TLE5011 kit			
M3x6 Phillips head screws	4	They come with the TLE5011 kit			



<b>Chair Base Add-on</b>		<b>Notes</b>	
1KG PETG OR PLA+ 1.75mm filament	1	These extra parts can be printed with PLA+	
M5x8mm Socket Head	8	For the crossbars	
M5x12mm Socket head	8	For the wheel chocks	
M5 vslot drop in nuts	16		
M6x12mm	4	For attaching the base to the 2020 bars	
<b>M6</b> vslot drop in nuts	4	MUST BE FOR 20 SERIES - NOT LARGER. FIT IN 6mm Groove	
2020 v slot aluminum rod - Cut to length	2	50cm is a good length.	
<b>Optional Add-ons</b>		<b>Notes</b>	
M4x20mm Socket Head	8	For the side covers	
M5x20mm Socket Head	4	For attaching the restrictor plate	
M3x8mm	2	For attaching the strain relief	
M5x8mm Socket Head	18	2020_CYC_OFFSET.3mf	y
M5 vslot drop in nuts	18	2020_CYC_OFFSET.3mf	y
<b>ELECTRICAL</b>		<b>Notes</b>	
5pin mini din connector (male) for TM adapter	1	<a href="https://www.aliexpress.com/item/32859748866.html">https://www.aliexpress.com/item/32859748866.html</a> or 2092-KMDVLX-5S-N-1-ND at digikey	y
TLE5010 sensor kit with magnet and PCB	2	<a href="https://www.aliexpress.com/item/4000549883214.html">https://www.aliexpress.com/item/4000549883214.html</a>	
Assorted 22 AWG wire in various colours	1	get at least a meter worth in several colours.	
STM32F103C8 microcontroller	1	Be careful to get the exact right version that supports Freejoy, beware of counterfeits	Y
Breakout PCB board	1	Can be ordered from PCBWAY: <a href="https://www.pcbway.com/project/share-project/Open_Source_Very_Large_Stick_Freejoy_MMjoy2_breakout_board_f66f472f.html">https://www.pcbway.com/project/share-project/Open_Source_Very_Large_Stick_Freejoy_MMjoy2_breakout_board_f66f472f.html</a>	
Arduino Pro Micro	1		

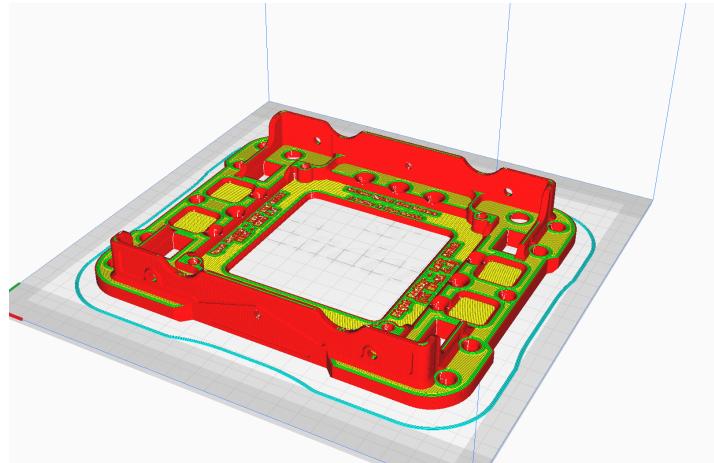


## 3mf Part Reference

Here is information on each 3mf file included with the build and a reference image showing the correct print orientation.

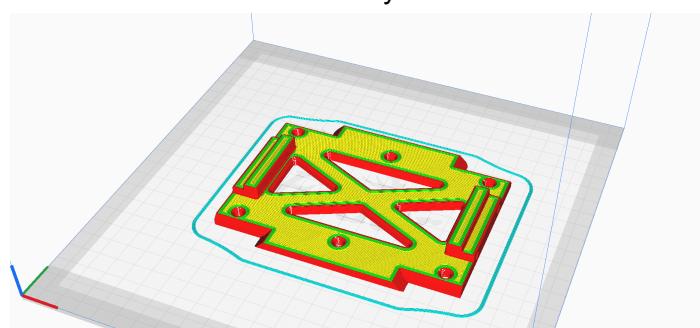
### PitchFrame\_TopPlate.3mf (*revised 1.3*)

Quantity: 2 (print with supports)



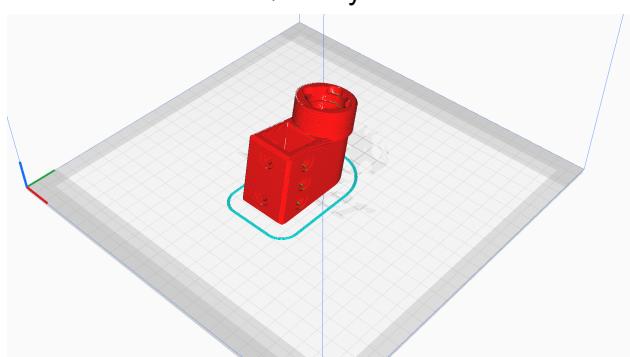
### PitchFrame\_SidePlate.3mf

Quantity: 2



### TM\_VIRPIL\_ADAPTER\_OFFSET.3mf (replaced the original TM mount)

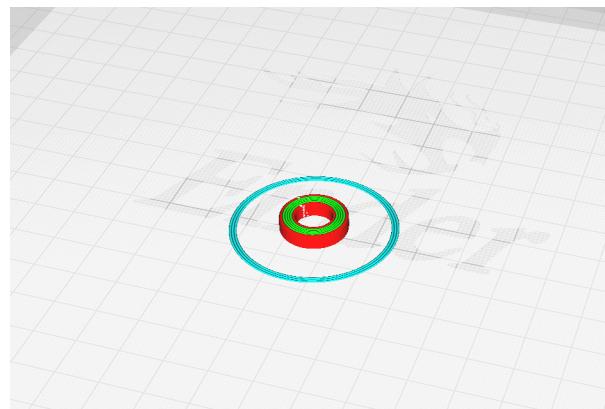
Quantity: 1



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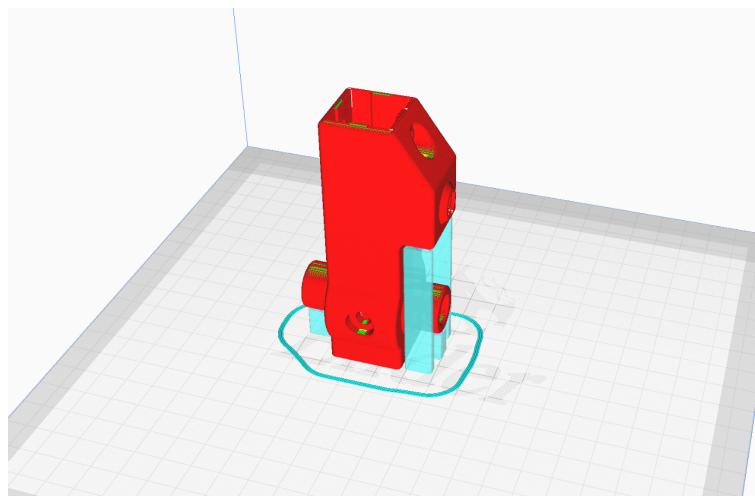
### Cam\_rollerSpacer.3mf

Quantity: 2



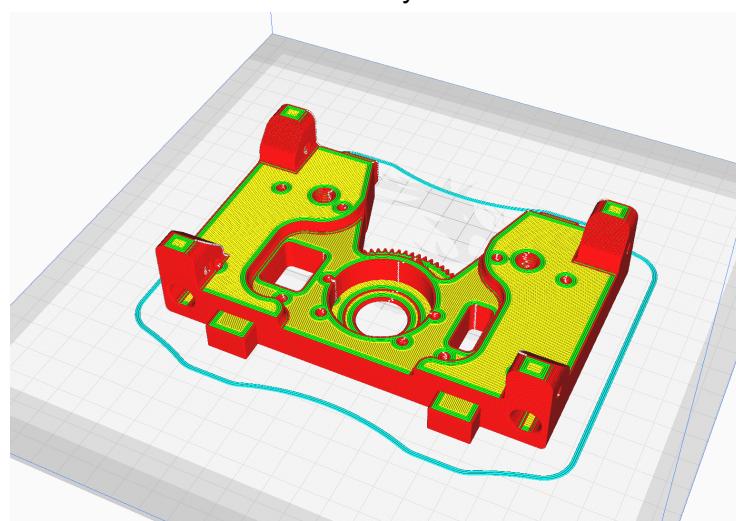
### MainSleeve.3mf

Quantity: 1 (print with supports)



### PitchFrame\_PillowBlock.3mf (**revised 1.3**)

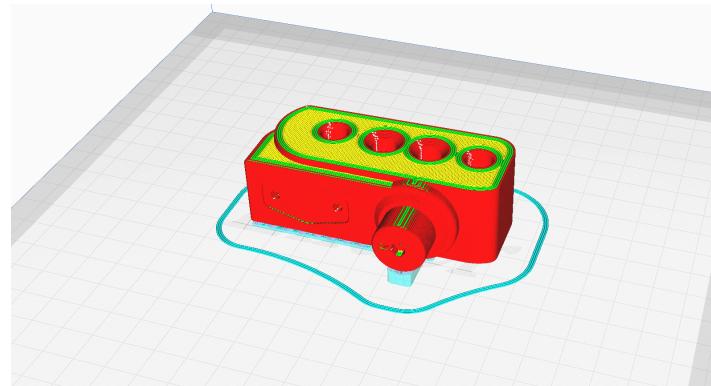
Quantity: 2



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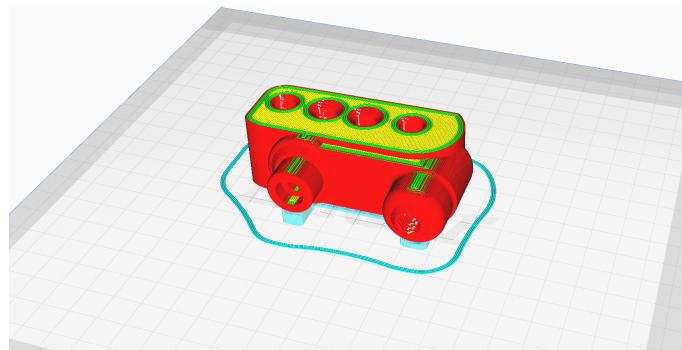
### RollFrame\_PitchPin\_Gear.3mf

Quantity: 1 (print with supports)



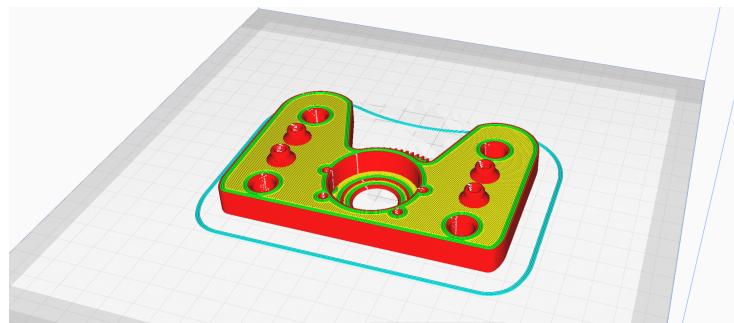
### RollFrame\_PitchPin\_Camside.3mf

Quantity: 1 (print with supports)



### RollFrame\_GearSide.3mf

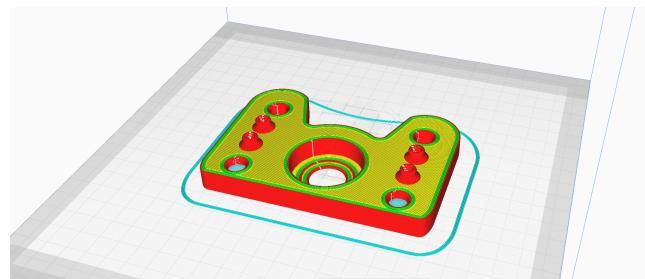
Quantity: 1



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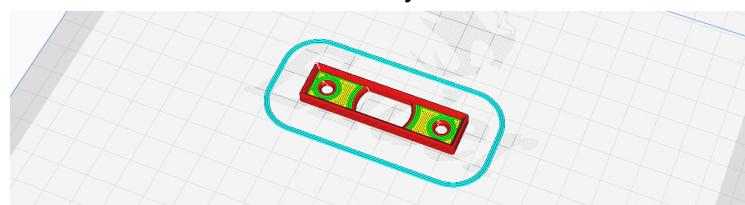
### RollFrame\_CamSide.3mf

Quantity: 1



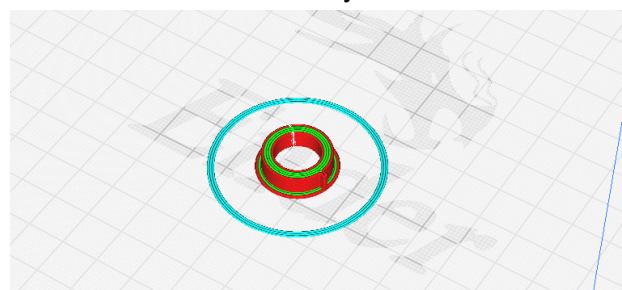
### TLE5011\_frame.3mf (new for 1.3)

Quantity: 2



### MINI\_DIN\_Holder.3mf (new for 1.3)

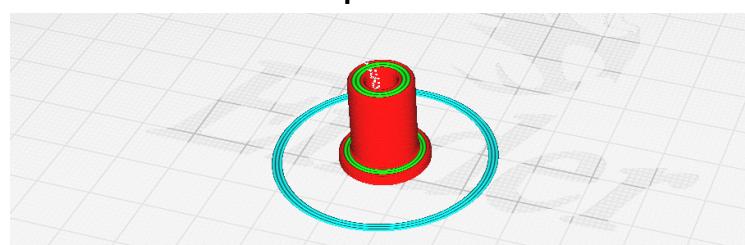
Quantity: 1



### M12\_WasherSpacer.3mf

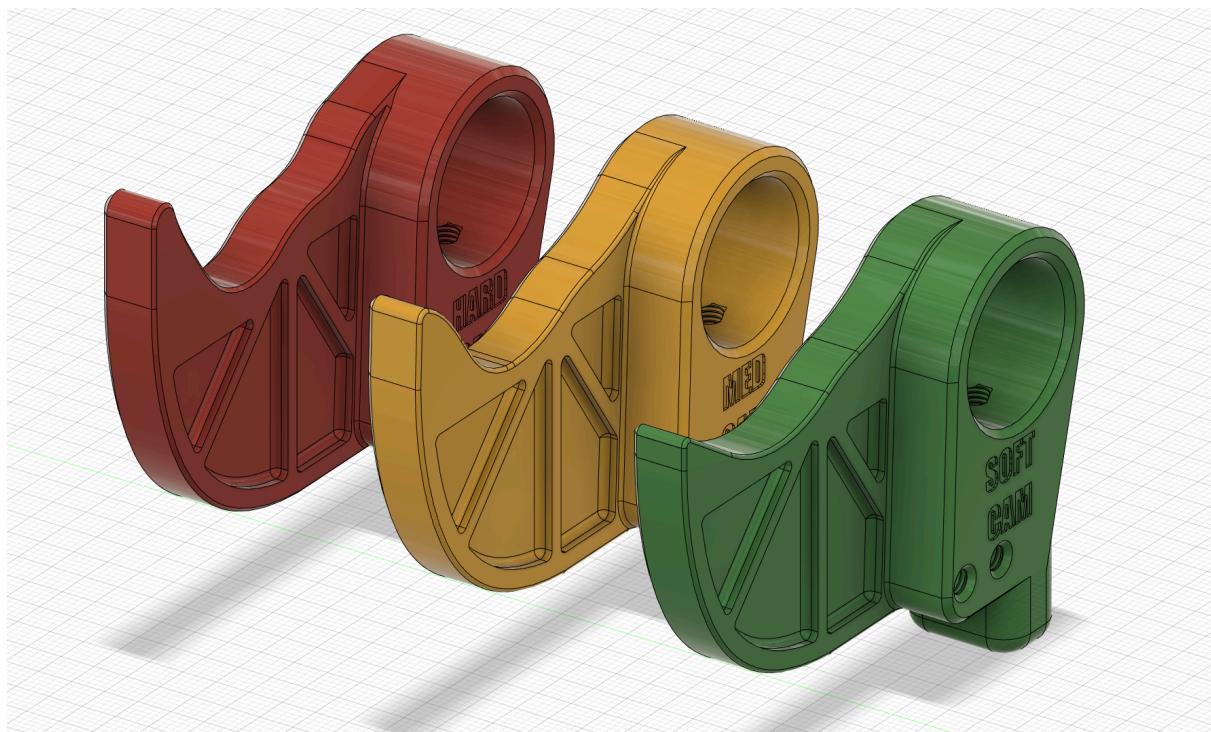
Quantity: 2

Optional



## CAM Profile Options

The design currently comes with three different options of CAM profiles. They can be mixed and matched on different axis to produce different force feelings, such as a stiffer pitch but a lighter roll motion. They are scaled from Soft to Hard.



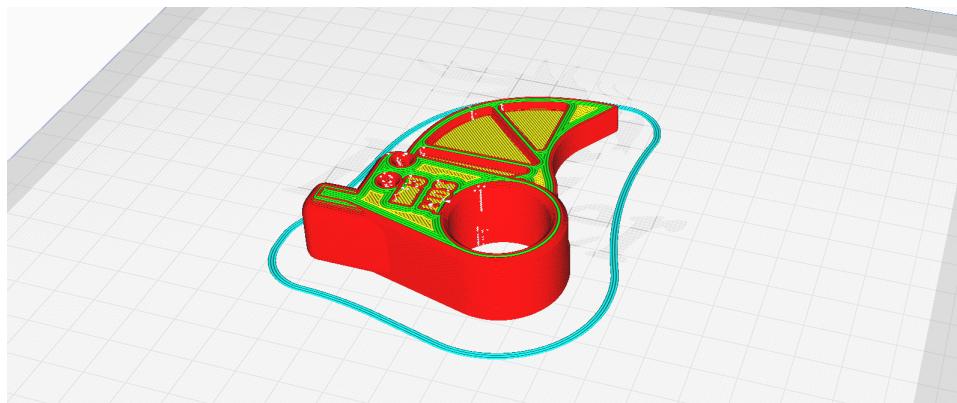
They also feature mounting for a bottom extension spring as well as 4 M4 holes on the side for mounting a secondary side spring. This can either augment the force of the primary spring or allow the use of a very light spring for low spring force applications like helicopter cyclics.



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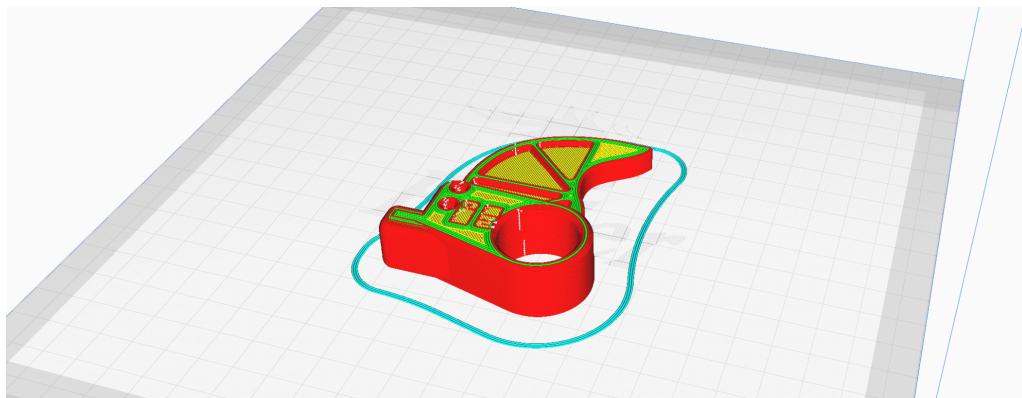
### SOFT\_CAM.3mf

Quantity: 4



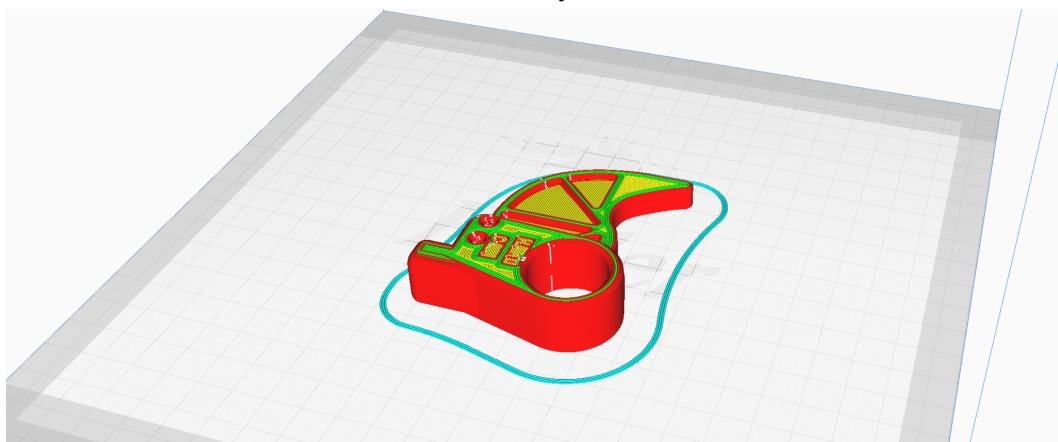
### MED\_CAM.3mf

Quantity: 4



### HARD\_CAM.3mf

Quantity: 4

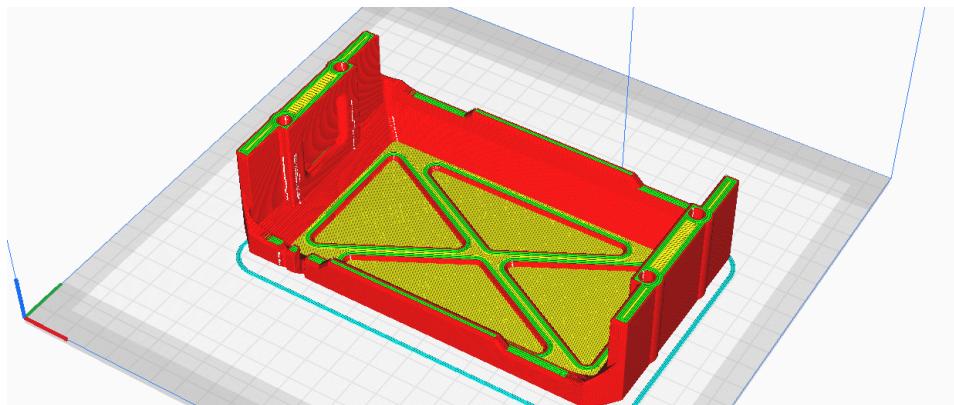


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## Optional Add-on Parts

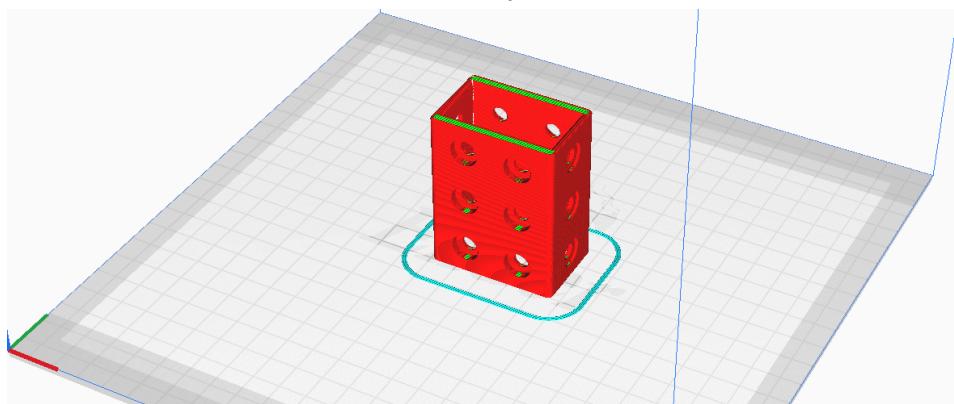
OuterCamCover\_Solid.3mf

Quantity: 2



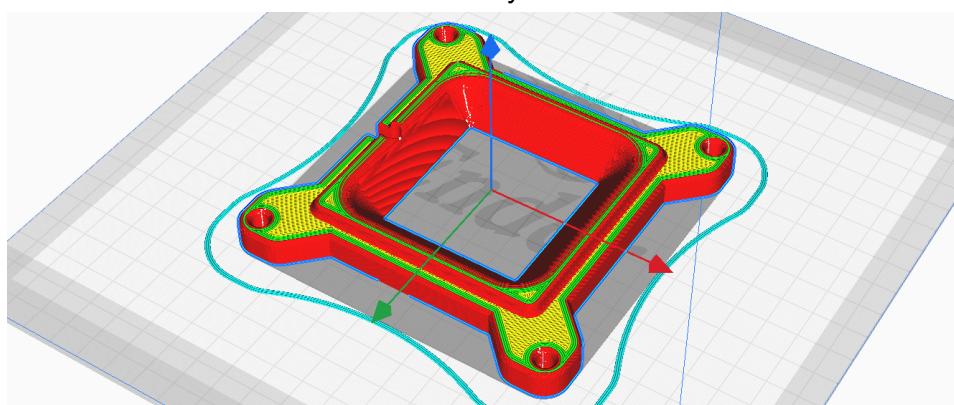
2020\_CYC\_OFFSET.3mf

Quantity: 1



Cyclic\_RestrictorPlate\_20degrees.3mf

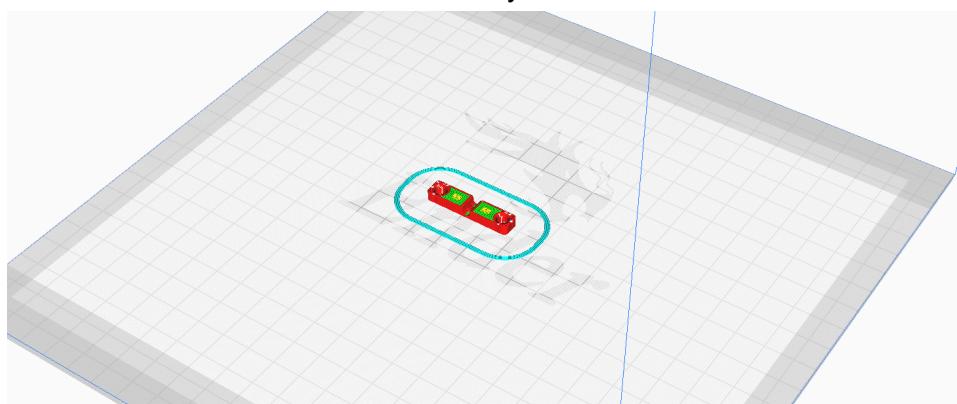
Quantity: 1



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## ASSY\_USBCABLE\_STRAIN\_RELIEF.3mf

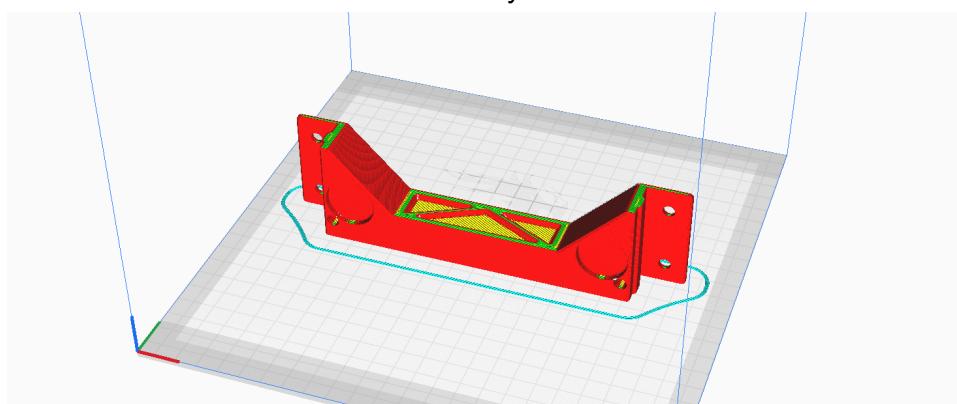
Quantity: 1



## Chair Base Add-on

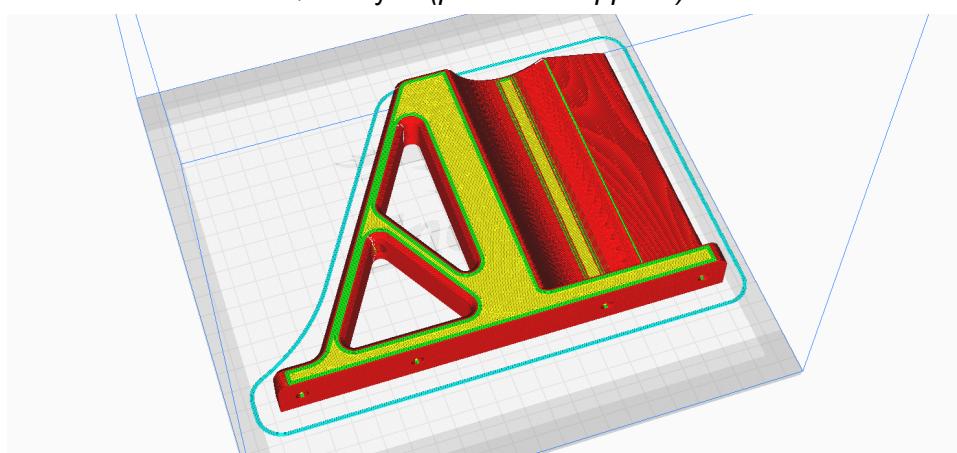
### 2020\_Crossbar.3mf

Quantity: 1



### CHAIR\_WHEELCHOCK.3mf

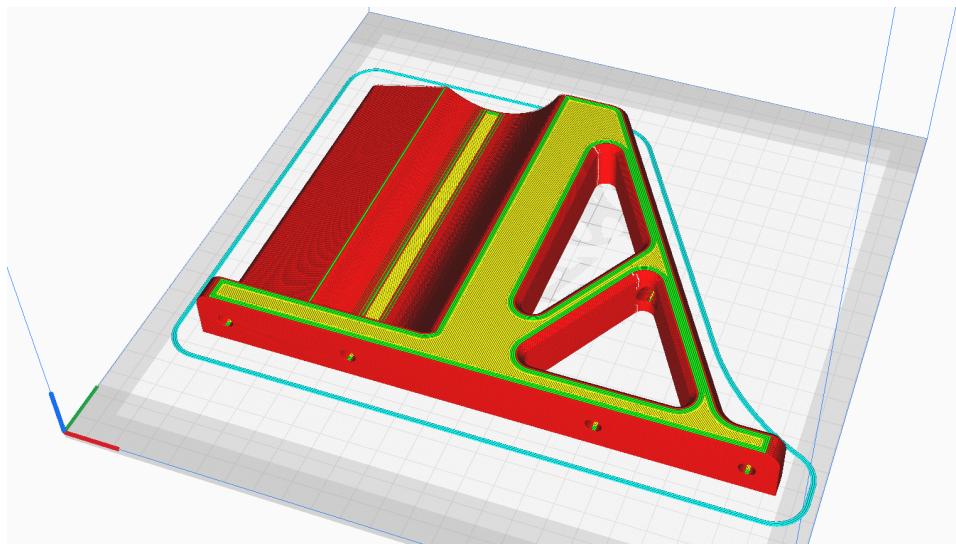
Quantity: 1 (*print with supports*)



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## CHAIR\_WHEELCHOCK\_Mirror.3mf

Quantity: 1 (*print with supports*)



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