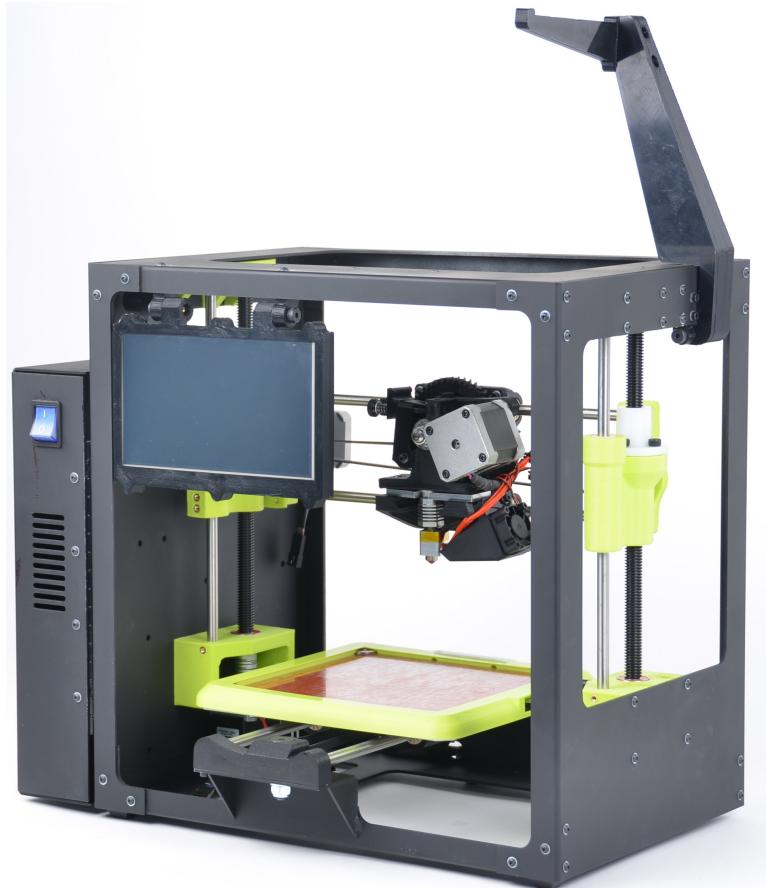


# LULZBOT MINI DEVELOPER'S GUIDE



**LulzBot Mini Developer's Guide**

**by Aleph Objects, Inc.**

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# **Introduction**

# **Welcome Aboard**

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## Audience

This is a developer's guide to hacking on the LulzBot Mini 3D Printer. It is meant for developers, not users, of the printer.

## Open Source Hardware, Free Software

Aleph Objects, Inc. is a Loveland, Colorado, USA company that manufactures Open Source Hardware using Free Software.

For more info, visit <http://www.alephobjects.com>.

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# **LulzBot Mini**

## **Developer Overview**

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## 1.1 LulzBot Mini

The LulzBot Mini is a 3D Printer currently under development. The abbreviated name is mini-dev.

The source files are available here:

<http://devel.lulzbot.com/mini/>

## 1.2 Versions

Each new version of the mini-dev has a new name, with the next letter in the alphabet.

- Azalea - First Prototype
- Begonia - Second Prototype, being built now
- Camellia - Third Prototype
- Daffodil - First Production batch

## 1.3 Begonia Photos

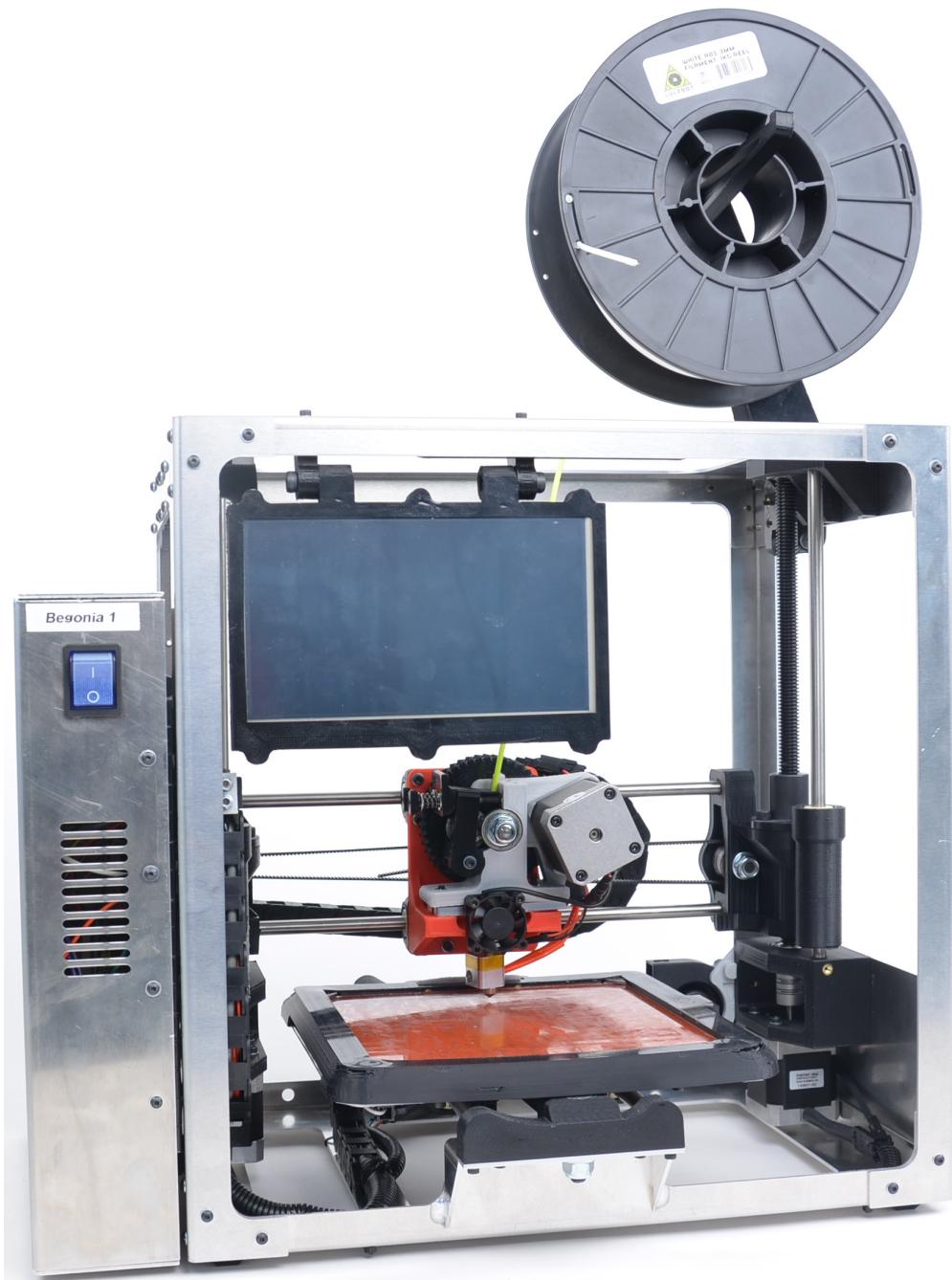


Figure 1.1: Begonia Front Photo

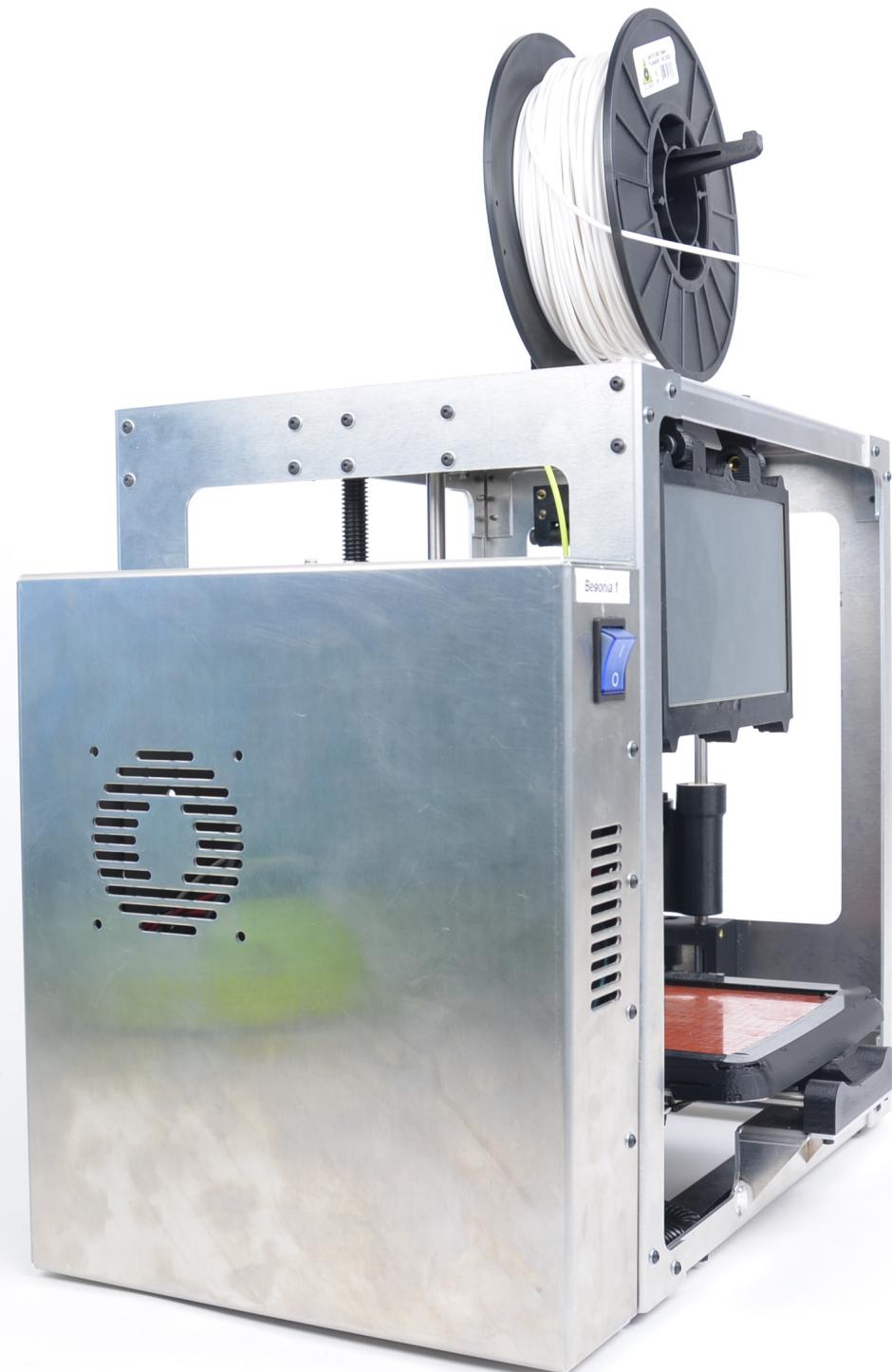


Figure 1.2: Begonia Left Photo

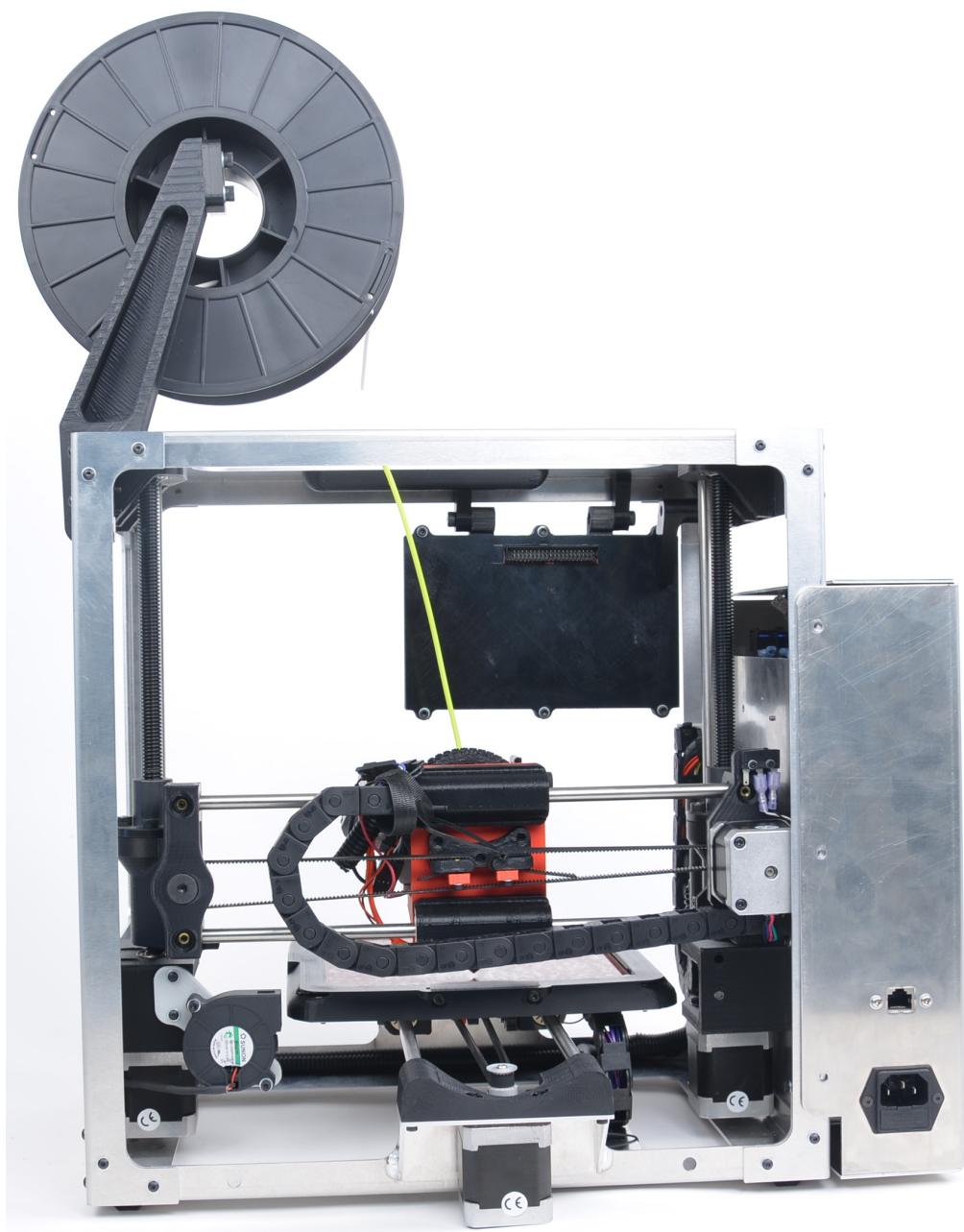


Figure 1.3: Begonia Back Photo

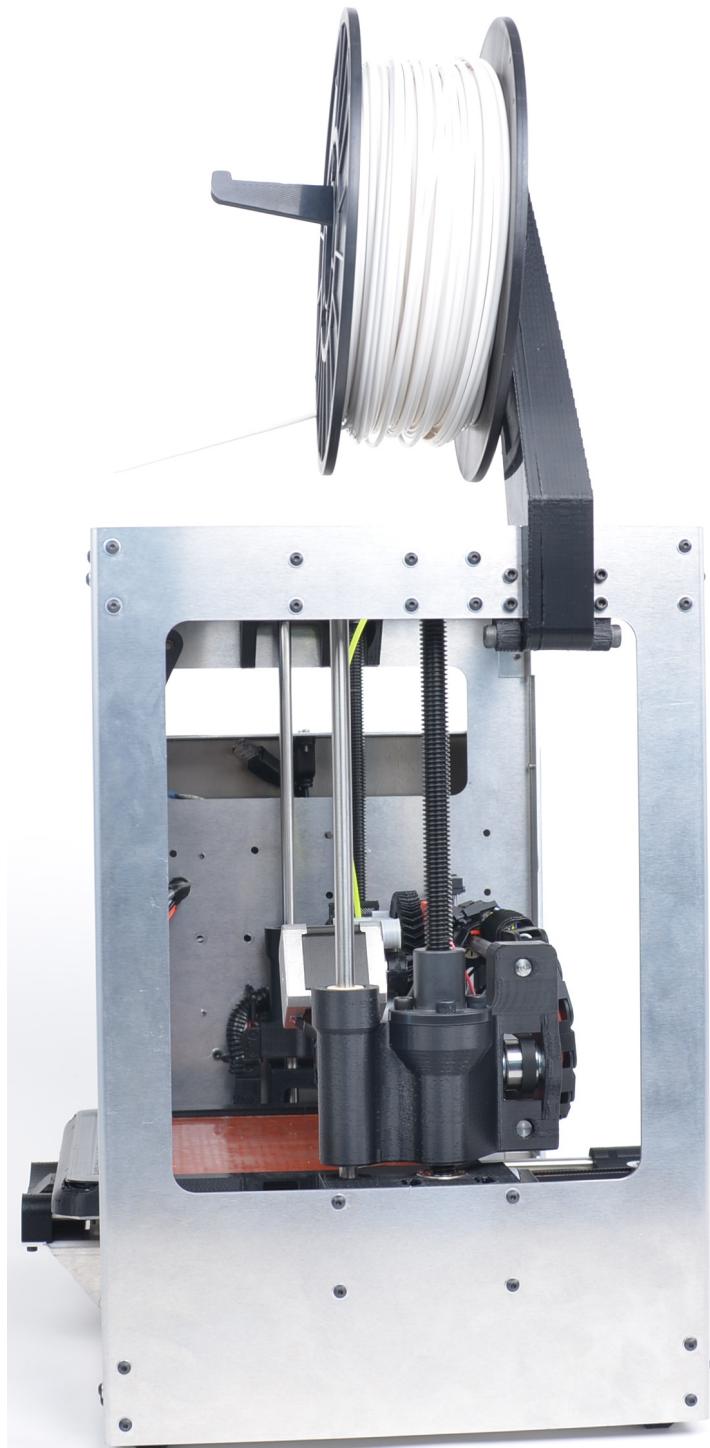


Figure 1.4: Begonia Right Photo

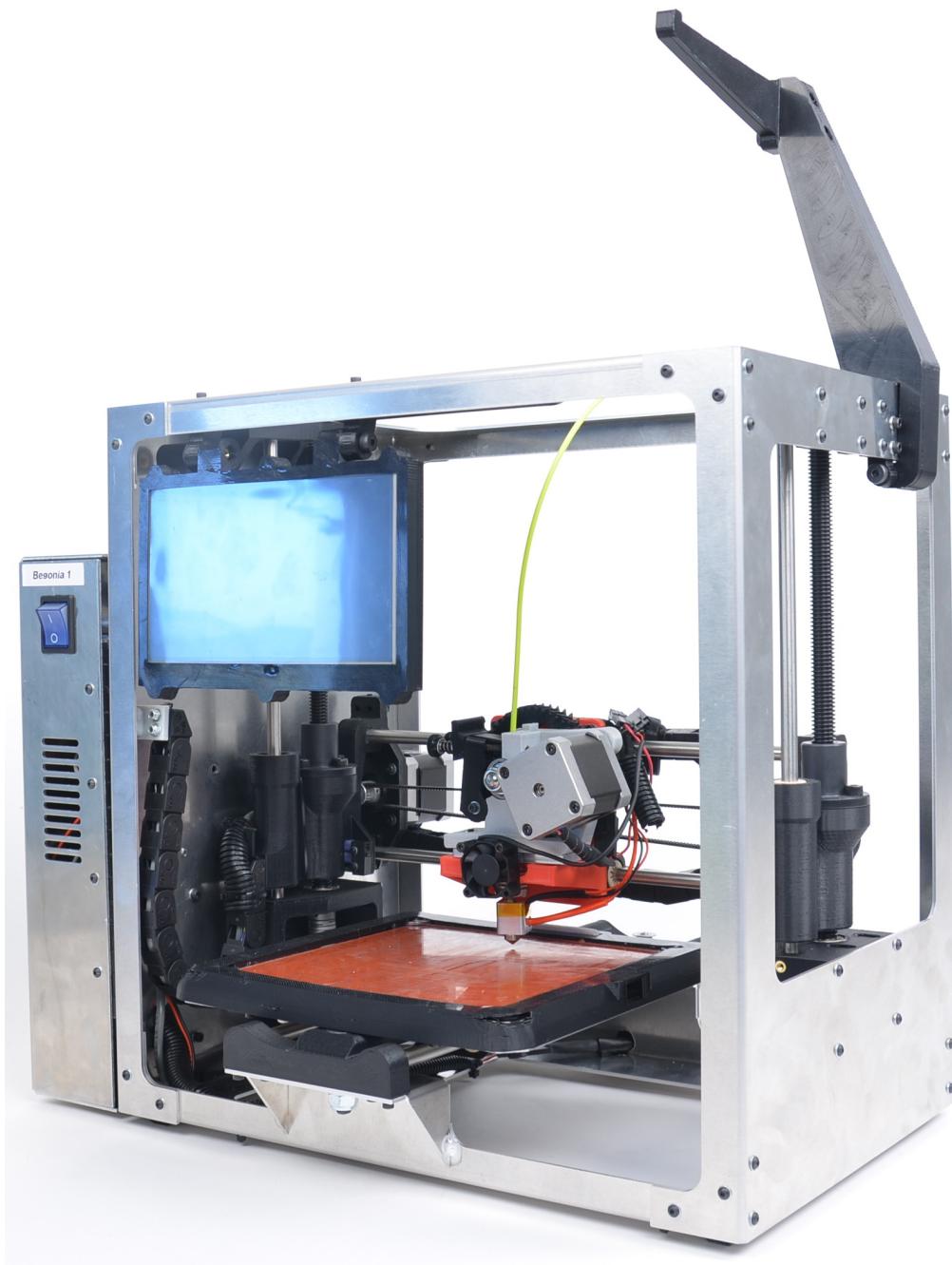


Figure 1.5: Begonia Spool Arm Up Photo

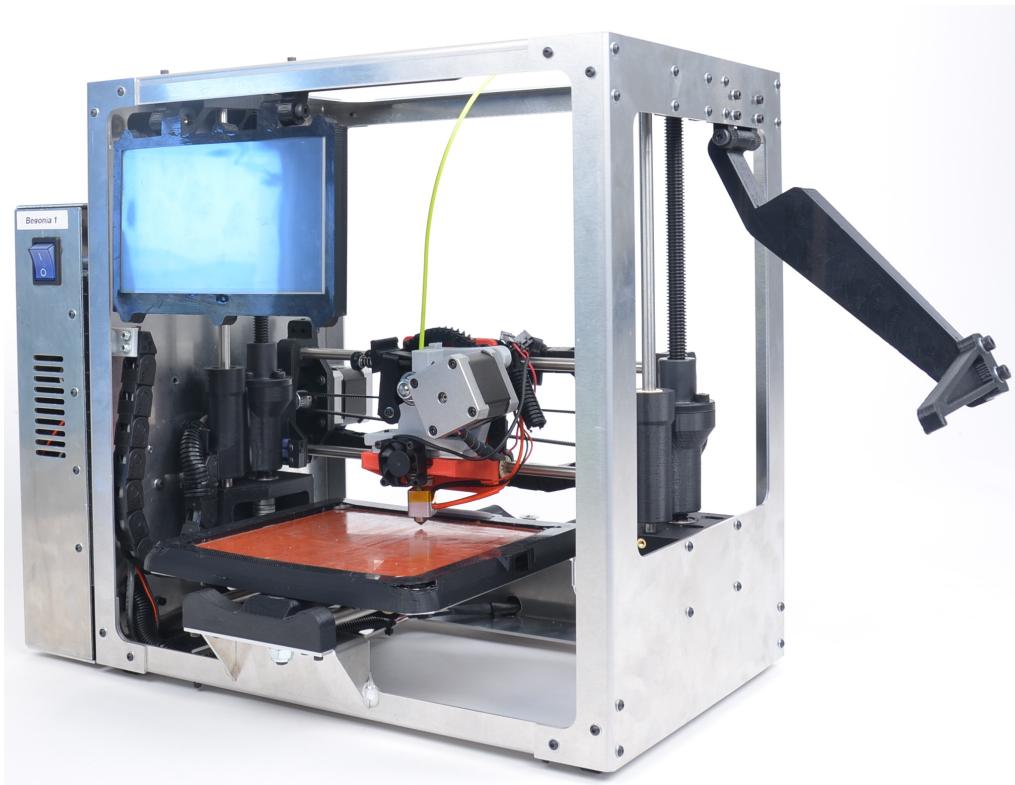


Figure 1.6: Begonia Spool Arm Down Photo



Figure 1.7: Begonia Green Color Scheme Photo

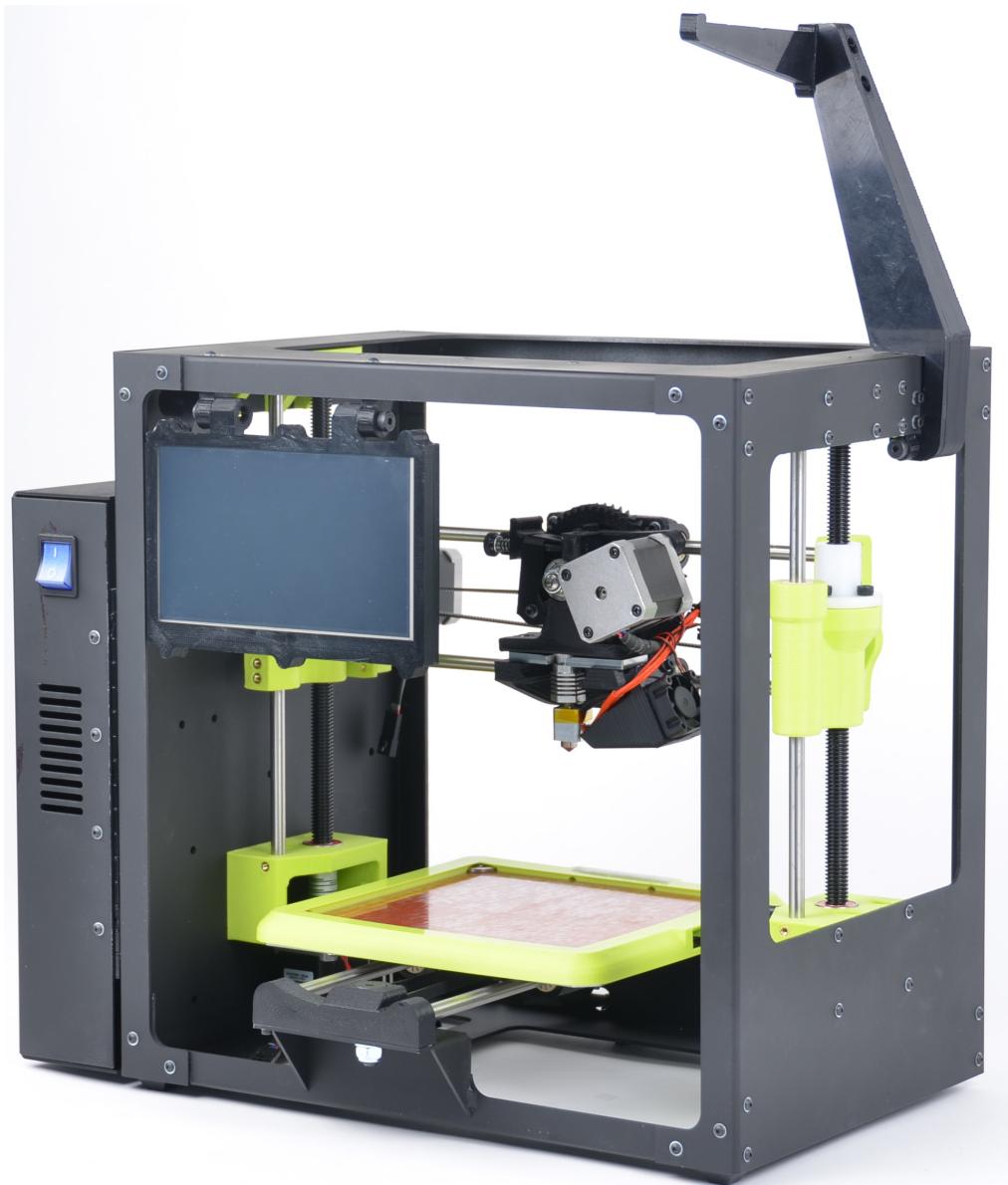


Figure 1.8: Begonia Black Green Color Scheme Photo

## 1.4. SCHEDULE

### 1.4 Schedule

The schedule is updated weekly. It is in Libre Office spreadsheet format.  
The latest version is available here:

[http://devel.lulzbot.com/mini/program\\_management/](http://devel.lulzbot.com/mini/program_management/)



---

# **Mechanical**

## **Cartesian Bot in X, Y, Z**

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## 2.1 Intro

Mechanical hardware specs and parts are in these subdirectories:

<http://devel.lulzbot.com/mini/>

## 2.2 Daffodil Bill of Materials

Daffodil is the first production run of units for retail.

Category	AO Part #	Description	Manufacturer	Manufacturer PN	Distributor	SKU	Distributor co	Advanced Antivibration co	Distributor	SKU	Qty Per	UOM	Price Per Unit	Price Total	Qty to Order
Hardware	HD-MS054	Square Bumper									2	ea	\$0.09	\$0.35	42 Sheets of 98
Printed	PP-GP0189	Double bearing holder v1.2, Mini	Aleph Objects								1	ea	\$3.00	\$6.02	
Printed	PP-GP0188	Upper bearing holder v1.1, Mini	Aleph Objects								1	ea	\$3.30	\$3.30	
Printed	PP-GP0187	X carriage cover v2.3, Mini	Aleph Objects								1	ea	\$1.750	\$1.75	
Printed	PP-GP0191	Herringbone Large Gear, Lulzbot green	Aleph Objects								1	ea	\$2.230	\$2.23	
Printed	PP-GP0192	Herringbone Small Gear, Lulzbot green	Aleph Objects								1	ea	\$0.290	\$0.29	
Printed	PP-GP0060	Wade Reloaded Bearing Washer	Aleph Objects								1	ea	\$0.020	\$0.02	
Printed	PP-GP0186	Wade extruder body for Hex nozzle v1.0	Aleph Objects								1	ea	\$3.790	\$3.79	
Printed	PP-GP0059	Wade Reloaded idle Block	Aleph Objects								1	ea	\$0.900	\$0.90	
Printed	PP-GP0091	extruder_latch	Aleph Objects								1	ea	\$0.260	\$0.26	
Printed	PP-GP0185	X end idler v2.3, Mini	Aleph Objects								1	ea	\$7.870	\$7.87	
Printed	PP-GP0184	Extruder mount v2.4, Mini	Aleph Objects								1	ea	\$3.690	\$3.69	
Printed	PP-GP0183	X carriage v1.0, Mini	Aleph Objects								1	ea	\$5.150	\$5.15	
Printed	PP-GP0182	X end motor v1.6, Mini	Aleph Objects								1	ea	\$8.740	\$8.74	
Printed	PP-GP0181	Beltmount v1.0, Mini	Aleph Objects								1	ea	\$1.260	\$1.26	
Printed	PP-GP0179	Z upper left v1.2, Mini	Aleph Objects								1	ea	\$3.010	\$3.01	
Printed	PP-GP0180	Z upper right v1.2, Mini	Aleph Objects								1	ea	\$3.010	\$3.01	
Printed	PP-GP0177	Z lower left v1.1, Mini, Lulzbot green	Aleph Objects								1	ea	\$5.150	\$5.15	
Printed	PP-GP0178	Z lower right v1.1, Mini, Lulzbot green	Aleph Objects								1	ea	\$7.090	\$7.09	
Printed	PP-GP0176	Bed corner v2.2, Mini	Aleph Objects								1	ea	\$1.070	\$1.07	
Printed	PP-GP0175	Bed corner v1.2, Mini	Aleph Objects								1	ea	\$2.230	\$2.23	
Printed	PP-GP0174	Y idle mount v1.1, Mini	Aleph Objects								1	ea	\$0.310	\$0.31	
Printed	PP-GP0173	Y rod mount v1.1, Mini	Aleph Objects								1	ea	\$0.870	\$0.87	
Printed	PP-GP0172	Spool hinge v1.3, Mini	Aleph Objects								1	ea	\$1.550	\$1.55	
Printed	PP-GP0171	Spool arm v1.0, Mini	Aleph Objects								1	ea	\$7.090	\$7.09	
Printed	PP-GP0170	Spool mount v1.2, Mini	Aleph Objects								1	ea	\$2.040	\$2.04	
Printed	PP-GP0169	Relief mount v1.3, Mini	Aleph Objects								1	ea	\$0.680	\$0.68	
Printed	PP-GP0168	Handle bar v2.4, Mini	Aleph Objects								1	ea	\$1.170	\$1.17	
Printed	PP-GP0167	Wiper mount v1.0, Mini	Aleph Objects								1	ea	\$0.190	\$0.19	
Mechanical	HD-MS0211	Fan Mount v1.3, Mini	Alien Scientific								1	ea	\$7.750	\$7.75	
Mechanical	HD-MS0227	Lower relief v1.0, Mini	Alien Scientific								1	ea	\$0.137	\$0.27	
Hardware	HD-BL0015	Bonoblock Glass Bed 170mm x 170mm	Associated Spring								2	ea	\$2.290	\$4.58	
Mechanical	HD-MS0033	Spring, Extruder, 6mm OD, 0.8mm WD, 9.7mm FL	B & B Manufacturing, Inc								2	ea	\$3.440	\$6.88	
Mechanical	HD-PS0025	G72, Single sided Neoprene Belt	IM6-CAS 5MM BORE ALL								2	ea	\$10.220	\$10.220	
Electronic	EL-MS0023	GT2 Timing Pulley, 5mm Bore Aluminum	PMC-24V150W1AA_DELTA								1	ea	\$28.600	\$28.60	
Electronic	EL-MS0024	POWER SUPPLY 150W 24V 6.25A PNL MT	22-28AWG								7	ea	\$0.077	\$0.54	
Electronic	EL-MS0025	Conn Fast Receptacle 1.6 AWG - 250	WM25LT TR-ND								25	ea	\$0.038	\$0.96	2 reels
Electronic	EL-MS0026	CONN TERM MALE 22-24AWG TIN	MOL16-02-0108								73	ea	\$0.056	\$3.26	4 reels
Electronic	EL-MS0027	CONN PIN 24-30AWG CRIMP TIN	WM25L0TR-ND								3	ea	\$0.140	\$0.42	
Electronic	EL-MS0028	CONN TERM FEMALE 22-24AWG TIN	WM25S5-ND								8	ea	\$0.112	\$0.90	
Electronic	EL-MS0029	CONN RECEPT FASTON 22-24AWG TIN	WM2902-ND								5	ea	\$0.062	\$0.31	
Electronic	EL-MS0030	Connector, 4 pin Male housing with latch	WM2900-ND								6	ea	\$0.060	\$0.36	
Electronic	EL-MS0031	CONN HOUSING 2POS, 1.00 W/LATCH	WM2901-ND								12	ea	\$0.109	\$1.31	
Electronic	EL-MS0032	CONN RECEPT FASTON 22-26AWG .110	A2779S-ND								6	ea	\$0.52	\$200	
Electronic	EL-MS0033	Term Ring Nuts 26-22AWG #4	P22-4R-M								2	ea	\$0.087	\$0.18	
Electronic	EL-MS0034	CONN RING UNINS 15-20AWG #M3	A1071500CT-ND								6	ea	\$0.090	\$0.54	
Electronic	EL-SW0022	<b>SWITCH BASIC SPDT 3A .10QC 125V</b>	<b>SW766-N0-ND</b>								6	ea	<b>\$3.12</b>	<b>\$18.00</b>	
Electronic	EL-WR0099	Shielded 4Cond 22AWG	C0762A_41.10								2470	mm	\$0.001	\$3.02	9000 ft
Electronic	EL-WR0105	24AWG Stranded - Black	C2015A-21.01								6025	mm	\$0.000	\$1.54	22000 ft
Electronic	EL-WR0107	24AWG Stranded - White	C2015A-21.02								1100	mm	\$0.000	\$0.28	40000 ft
Electronic	EL-WR0109	24AWG Stranded - Yellow	C2015A-21.05								2090	mm	\$0.000	\$0.54	8000 ft
Electronic	EL-WR0103	24AWG Stranded - Red	Digikey								3825	mm	\$0.000	\$0.98	14000 ft
Electronic	EL-WR0104	24AWG Stranded - Orange	C2015A-21.04								460	mm	\$0.000	\$0.72	11000 ft
Electronic	EL-WR0118	24AWG Stranded - Blue	C2015A-21.07								520	mm	\$0.000	\$0.14	20000 ft
Electronic	EL-WR0119	24AWG Stranded - Green	C2015A-21.06								1210	mm	\$0.000	\$0.16	20000 ft
Electronic	EL-WR0120	24AWG Stranded - Purple	C2015A-21.10								2065	mm	\$0.000	\$0.31	50000 ft
Electronic	EL-WR0106	16AWG Stranded - Red	C2065A-21.03								400	mm	\$0.007	\$2.78	20000 ft
Electronic	EL-WR0121	16AWG Stranded - Black	C2065B-100-ND								1280	mm	\$0.007	\$8.89	40000 ft

<b>Electronic</b>	<b>EL-WR0122</b>	<b>16AWG Stranded - Green</b>	<b>C2065A21.06</b>	<b>Digikey</b>	C2065A21.02	\$6.11	<b>\$0.87</b>	<b>1000 ft</b>
Electronic	EL-WR0123	16AWG Stranded - White		Digikey		\$0.007		
Electronic	EL-WR0108	16AWG Stranded - Violet		Digikey		\$0.001		
Electronic	EL-MS0216	Ferrite Tubular Bead 19.0mm		Digikey				
Electronic	PC-CN0046	Term Block Plug 4PQS STR 5.08MM		TII	240-2314-ND	1		
Electronic	PC-CN0032	Term Block Plug 2PQS STR 5.08MM		TII	WN7953-ND	1		
Electronic	EL-MS0074	20-POS_1.00 Dual (Black)		TII	WN7819-ND	2		
Electronic	EL-MS0211	REEL - RING TONGUE CONN 16-22 AWG 410 PIDS	TE	Digikey	WN2527-ND	2		
Hardware	HE-SH0031	Repli-Modifed Hexagon Holed, Luzbot Edition, 3.0mm Filament		Repli-discount	A1062TR-ND	7		
Mechanical	PP-FP0055	Left Plate,	EPOCS					
Mechanical	PP-FP0052	Right Plate,	EPOCS					
Mechanical	PP-FP0051	Top Plate,	EPOCS					
Mechanical	PP-FP0053	Bottom Plate,	EPOCS					
Mechanical	PP-FP0054	Bed Mount Plate,	EPOCS					
Mechanical	PP-FP0056	Electronics cover,	Rapid Sheet Metal					
Mechanical	PP-FP0055	Left Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0052	Right Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0051	Top Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0053	Bottom Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0054	Bed Mount Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0056	Electronics cover,	Rapid Sheet Metal					
Hardware	EL-MS0165	Snaps-Together Cable and Hose Carrier, Feed-Through, 0.41" High x 0.39" Wide Interior SIGS	Rapid Sheet Metal					
Hardware	EL-MS0166	Mounting Brackets for .41" High x .39" Wide Interior Snap-Together Cable and Hose Carriers	Rapid Sheet Metal					
Mechanical	HD-BU00143	EMI/RFI-Shield Heat-Shrink Tubing - Solid polymer bearing R/W:0L_8mm	IGUM					
Electronic	EL-FA0011	FAN 24VDC, Sleeve 5.75CFM, 10x40x10MM, 60mA 6000RPM, 1.44W/2	Kysan					
Electronic	EL-FA0012	FAN 24VDC, BAL 31.60CFM, 80x80x15 MM, 100mA	TF8015-24M-B					
Mechanical	HD-RB0035	8mm Smooth Rod, 31.5mm	Kyocera					
Mechanical	HD-RB0044	304 Stainless Steel	MBK					
Hardware	HD-BT0108	Holurbed Bolt, M8 x 50mm Hex head, 26mm offset, Stainless Steel	Quattro					
Hardware	PP-MF0082	Bed leveling washer, 2013 SST	MBK					
Electronics	TL-CS0083	EMI/RFI-Shield Heat-Shrink Tubing, 3/16" ID Before, 3/32" ID After, 3/16" ID Before, 3/16" ID After	TECflex					
Electronics	TL-CS0129	Interference-Shielding Heat-Shrink Tubing, 3/8" ID Before, 3/8" ID After	TECflex					
Hardware	HD-WA0035	Metric 18-8 Stainless Steel External Serrated Loc. Washer, M3 Screw Size, 6mm OD, 0.4mm ID	McMaster					
Hardware/tools	HD-MS0244	Firm White Polyester Felt Strip, 1/4" Thick, 1" Width, Plain Back	McMaster					
Hardware	HD-MS0235	Metric Aluminum Unthreaded Spacer, 4.5mm OD, 8mm Length	McMaster					
Electronics	EL-MS0273	Tubing, Corrugated Loom, 25"	Fastenal					
Hardware	HD-BT0117	Black Alloy Steel Flat-Head Socket Cap Screw, Class 10.9, M8 Size, 40mm Length	Timberline					
Hardware	HD-BT0131	Black Alloy Steel Flat-Head Socket Cap Screw, Class 10.9, M8 Size, 45mm Length	Timberline					
Hardware	PP-MF0066	Metric Brass Heat-Set-Inserter for Plastics, Tapered, M2-4 Internal Thread, 2.96MM Length	McMaster					
Hardware	HD-BT0107	Metric Class 12.9 Socket Head Cap Screw Alloy Steel, Black, M2 Thread, 10mm Length, 0.4mm Fastener	McMaster					
Hardware	HD-WA0012	Steel Flat Washer, DIN 125 zinc-plated class 4/N2 screw sz, 5mm OD, 40350	Fastenal					
Hardware	HD-MS0230	M2 x 6 SHCS, Black-Oxide	Timberline					
Hardware	HD-MS0030	M3-.5 3.8mm Heatset Insert	Fastenal					
Hardware	HD-MS0258	M5-.8 6.7mm Heatset Insert	Fastenal					
Hardware	HD-NT0004	M3 Nyloc Nut, Zinc Plated	Timberline					
Hardware	HD-NT0004	M3 Nut, Zinc Plated	Timberline					
Hardware	HD-BT0012	M3 Set Screw (Grub Screw)	Timberline					
Hardware	HD-WA0001	M3 Washer, Steel, Zinc Plated	Timberline					
Hardware	HD-BT0044	M3 x 5 Bolt, SHCS Black-Oxide	Timberline					
Hardware	HD-BT0128	M3 x 6 Bolt, FHCS Black-Oxide	Timberline					
Hardware	HD-BT0104	M3 x 8 Bolt, BHCS SST	Timberline					
Hardware	HD-BT0137	M3 x 8 Bolt, BHCS, Black-Oxide	Timberline					
Hardware	HD-BT0039	M3 x 12 Bolt, SHCS Black-Oxide	Timberline					
Hardware	HD-BT0118	M3 x 14 Bolt FHCS, Black-Oxide	Timberline					
Hardware	HD-BT0136	M3 x 12 Bolt FHCS, SST	Timberline					
Hardware	HD-BT0135	M3 x 8 Bolt FHCS, Black-Oxide	Timberline					
Hardware	HD-BT0041	M3 x 25 Bolt, SHCS Black-Oxide	Timberline					
Hardware	HD-NT0011	M4 Nut, Zinc-Plated Steel	Timberline					
<b>Electronic</b>	<b>C2065G-1000-ND</b>	<b>16AWG Stranded - Green</b>	<b>C2065A21.06</b>	<b>Digikey</b>	C2065W-100-ND	880	<b>\$0.007</b>	<b>1000 ft</b>
Electronic	EL-WR0123	16AWG Stranded - White		Digikey	C2065V-100-ND	1100		
Electronic	EL-WR0108	16AWG Stranded - Violet		Digikey	240-2314-ND	1		
Electronic	EL-MS0216	Ferrite Tubular Bead 19.0mm		Digikey	WN7953-ND	1		
Electronic	PC-CN0046	Term Block Plug 4PQS STR 5.08MM		TII	WN7819-ND	2		
Electronic	PC-CN0032	Term Block Plug 2PQS STR 5.08MM		TII	WN2527-ND	2		
Electronic	EL-MS0074	20-POS_1.00 Dual (Black)		TII	A1062TR-ND	7		
Hardware	HE-SH0031	Repli-Modifed Hexagon Holed, Luzbot Edition, 3.0mm Filament		Repli-discount				
Mechanical	PP-FP0055	Left Plate,	EPOCS					
Mechanical	PP-FP0052	Right Plate,	EPOCS					
Mechanical	PP-FP0051	Top Plate,	EPOCS					
Mechanical	PP-FP0053	Bottom Plate,	EPOCS					
Mechanical	PP-FP0054	Bed Mount Plate,	EPOCS					
Mechanical	PP-FP0056	Electronics cover,	EPOCS					
Mechanical	PP-FP0055	Left Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0052	Right Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0051	Top Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0053	Bottom Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0054	Bed Mount Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0056	Electronics cover,	Rapid Sheet Metal					
Hardware	EL-MS0165	Snaps-Together Cable and Hose Carrier, Feed-Through, 0.41" High x 0.39" Wide Interior SIGS	Rapid Sheet Metal					
Hardware	EL-MS0166	Mounting Brackets for .41" High x .39" Wide Interior Snap-Together Cable and Hose Carriers	Rapid Sheet Metal					
Mechanical	HD-BU00143	EMI/RFI-Shield Heat-Shrink Tubing - Solid polymer bearing R/W:0L_8mm	IGUM					
Electronic	EL-FA0011	FAN 24VDC, Sleeve 5.75CFM, 10x40x10MM, 60mA 6000RPM, 1.44W/2	Kysan					
Electronic	EL-FA0012	FAN 24VDC, BAL 31.60CFM, 80x80x15 MM, 100mA	TF8015-24M-B					
Mechanical	HD-RB0035	8mm Smooth Rod, 31.5mm	Kyocera					
Mechanical	HD-RB0044	304 Stainless Steel	MBK					
Hardware	HD-BT0108	Holbed Bolt, M8 x 50mm Hex head, 26mm offset, Stainless Steel	Quattro					
Hardware	PP-MF0082	Bed leveling washer, 2013 SST	MBK					
Electronics	TL-CS0083	EMI/RFI-Shield Heat-Shrink Tubing, 3/16" ID Before, 3/32" ID After, 3/16" ID Before, 3/16" ID After	TECflex					
Electronics	TL-CS0129	Interference-Shielding Heat-Shrink Tubing, 3/8" ID Before, 3/8" ID After	TECflex					
Hardware	HD-WA0035	Metric 18-8 Stainless Steel External Serrated Loc. Washer, M3 Screw Size, 6mm OD, 0.4mm ID	McMaster					
Hardware/tools	HD-MS0244	Firm White Polyester Felt Strip, 1/4" Thick, 1" Width, Plain Back	McMaster					
Hardware	HD-MS0235	Metric Aluminum Unthreaded Spacer, 4.5mm OD, 8mm Length	McMaster					
Electronics	EL-MS0273	Tubing, Corrugated Loom, 25"	Fastenal					
Hardware	HD-BT0117	Black Alloy Steel Flat-Head Socket Cap Screw, Class 10.9, M8 Size, 40mm Length	Timberline					
Hardware	HD-BT0131	Black Alloy Steel Flat-Head Socket Cap Screw, Class 10.9, M8 Size, 45mm Length	Timberline					
Hardware	PP-MF0066	Metric Brass Heat-Set-Inserter for Plastics, Tapered, M2-4 Internal Thread, 2.96MM Length	McMaster					
Hardware	HD-BT0107	Metric Class 12.9 Socket Head Cap Screw Alloy Steel, Black, M2 Thread, 10mm Length, 0.4mm Fastener	McMaster					
Hardware	HD-WA0012	Steel Flat Washer, DIN 125 zinc-plated class 4/N2 screw sz, 5mm OD, 40350	Fastenal					
Hardware	HD-MS0230	M2 x 6 SHCS, Black-Oxide	Timberline					
Hardware	HD-MS0030	M3-.5 3.8mm Heatset Insert	Fastenal					
Hardware	HD-MS0258	M5-.8 6.7mm Heatset Insert	Fastenal					
Hardware	HD-NT0004	M3 Nyloc Nut, Zinc Plated	Timberline					
Hardware	HD-NT0004	M3 Nut, Zinc Plated	Timberline					
Hardware	HD-BT0012	M3 Set Screw (Grub Screw)	Timberline					
Hardware	HD-WA0001	M3 Washer, Steel, Zinc Plated	Timberline					
Hardware	HD-BT0044	M3 x 5 Bolt, SHCS Black-Oxide	Timberline					
Hardware	HD-BT0128	M3 x 6 Bolt, FHCS Black-Oxide	Timberline					
Hardware	HD-BT0104	M3 x 8 Bolt, BHCS SST	Timberline					
Hardware	HD-BT0137	M3 x 8 Bolt, BHCS, Black-Oxide	Timberline					
Hardware	HD-BT0039	M3 x 12 Bolt, SHCS Black-Oxide	Timberline					
Hardware	HD-BT0118	M3 x 14 Bolt FHCS, Black-Oxide	Timberline					
Hardware	HD-BT0136	M3 x 12 Bolt FHCS, SST	Timberline					
Hardware	HD-BT0135	M3 x 6 Bolt, FHCS, Black-Oxide	Timberline					
Hardware	HD-BT0041	M3 x 25 Bolt, SHCS Black-Oxide	Timberline					
Hardware	HD-NT0011	M4 Nut, Zinc-Plated Steel	Timberline					
<b>Electronic</b>	<b>C2065G-1000-ND</b>	<b>16AWG Stranded - Green</b>	<b>C2065A21.06</b>	<b>Digikey</b>	C2065W-100-ND	880	<b>\$0.007</b>	<b>1000 ft</b>
Electronic	EL-WR0123	16AWG Stranded - White		Digikey	C2065V-100-ND	1100		
Electronic	EL-WR0108	16AWG Stranded - Violet		Digikey	240-2314-ND	1		
Electronic	EL-MS0216	Ferrite Tubular Bead 19.0mm		Digikey	WN7953-ND	1		
Electronic	PC-CN0046	Term Block Plug 4PQS STR 5.08MM		TII	WN7819-ND	2		
Electronic	PC-CN0032	Term Block Plug 2PQS STR 5.08MM		TII	WN2527-ND	2		
Electronic	EL-MS0074	20-POS_1.00 Dual (Black)		TII	A1062TR-ND	7		
Hardware	HE-SH0031	Repli-Modifed Hexagon Holed, Luzbot Edition, 3.0mm Filament		Repli-discount				
Mechanical	PP-FP0055	Left Plate,	EPOCS					
Mechanical	PP-FP0052	Right Plate,	EPOCS					
Mechanical	PP-FP0051	Top Plate,	EPOCS					
Mechanical	PP-FP0053	Bottom Plate,	EPOCS					
Mechanical	PP-FP0054	Bed Mount Plate,	EPOCS					
Mechanical	PP-FP0056	Electronics cover,	EPOCS					
Mechanical	PP-FP0055	Left Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0052	Right Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0051	Top Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0053	Bottom Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0054	Bed Mount Plate,	Rapid Sheet Metal					
Mechanical	PP-FP0056	Electronics cover,	Rapid Sheet Metal					
Hardware	EL-MS0165	Snaps-Together Cable and Hose Carrier, Feed-Through, 0.41" High x 0.39" Wide Interior SIGS	Rapid Sheet Metal					
Hardware	EL-MS0166	Mounting Brackets for .41" High x .39" Wide Interior Snap-Together Cable and Hose Carriers	Rapid Sheet Metal					
Mechanical	HD-BU00143	EMI/RFI-Shield Heat-Shrink Tubing - Solid polymer bearing R/W:0L_8mm	IGUM					
Electronic	EL-FA0011	FAN 24VDC, Sleeve 5.75CFM, 10x40x10MM, 60mA 6000RPM, 1.44W/2	Kysan					
Electronic	EL-FA0012	FAN 24VDC, BAL 31.60CFM, 80x80x15 MM, 100mA	TF8015-24M-B					
Mechanical	HD-RB0035	8mm Smooth Rod, 31.5mm	Kyocera					
Mechanical	HD-RB0044	304 Stainless Steel	MBK					
Hardware	HD-BT0108	Holbed Bolt, M8 x 50mm Hex head, 26mm offset, Stainless Steel	Quattro					
Hardware	PP-MF0082	Bed leveling washer, 2013 SST	MBK					
Electronics	TL-CS0083	EMI/RFI-Shield Heat-Shrink Tubing, 3/16" ID Before, 3/32" ID After	TECflex					
Electronics	TL-CS0129	Interference-Shielding Heat-Shrink Tubing, 3/8" ID Before, 3/8" ID After	TECflex					
Hardware	HD-WA0035	Metric 18-8 Stainless Steel External Serrated Loc. Washer, M3 Screw Size, 6mm OD, 0.4mm ID	McMaster					
Hardware/tools	HD-MS0244	Firm White Polyester Felt Strip, 1/4" Thick, 1" Width, Plain Back	McMaster					
Hardware	HD-MS0235	Metric Aluminum Unthreaded Spacer, 4.5mm OD, 8mm Length	McMaster					
Electronics	EL-MS0273	Tubing, Corrugated Loom, 25"	Fastenal					
Hardware	HD-BT0117	Black Alloy Steel Flat-Head Socket Cap Screw, Class 10.9, M8 Size, 40mm Length	Timberline					
Hardware	HD-BT0131	Black Alloy Steel Flat-Head Socket Cap Screw, Class 10.9, M8 Size, 45mm Length	Timberline					
Hardware	PP-MF0066	Metric Brass Heat-Set-Inserter for Plastics, Tapered, M2-4 Internal Thread, 2.96MM Length	McMaster					
Hardware	HD-BT0107	Metric Class 12.9 Socket Head Cap Screw Alloy Steel, Black, M2 Thread, 10mm Length, 0.4mm Fastener	McMaster					
Hardware	HD-WA0012	Steel Flat Washer, DIN 125 zinc-plated class 4/N2 screw sz, 5mm OD, 40350	Fastenal					
Hardware	HD-MS0230	M2 x 6 SHCS, Black-Oxide	Timberline					
Hardware	HD-MS0030	M3-.5 3.8mm Heatset Insert	Fastenal					
Hardware	HD-MS0258	M5-.8 6.7mm Heatset Insert	Fastenal					
Hardware	HD-NT0004	M3 Nyloc Nut, Zinc Plated	Timberline					
Hardware	HD-NT0004	M3 Nut, Zinc Plated	Timberline					
Hardware	HD-BT0012	M3 Set Screw (Grub Screw)	Timberline					
Hardware	HD-WA0001	M3 Washer, Steel, Zinc Plated	Timberline					
Hardware	HD-BT0044	M3 x 5 Bolt, SHCS Black-Oxide	Timberline					
Hardware	HD-BT0128	M3 x 6 Bolt, FHCS Black-Oxide	Timberline					
Hardware	HD-BT0104	M3 x 8 Bolt, BHCS SST	Timberline					
Hardware	HD-BT0137	M3 x 8 Bolt, BHCS, Black-Oxide	Timberline					
Hardware	HD-BT0039	M3 x 12 Bolt, SHCS Black-Oxide						

Hardware	HD-WA0005	M4 Washer	Timberline	8206-0040	\$0.00	6	ea	\$0.02	6000
Hardware	HD-MS0229	M4 x 25 Bolt, SHCS Black-Oxide	mcmaster	91290A176	\$0.137	2	ea	\$0.16	2020
Hardware	HD-BT0052	M4 x 55 Bolt, SHCS Black-Oxide	mcmaster	NS050-055	\$0.08	2	ea	\$0.24	11200
<b>Hardware</b>	<b>HD-WA0007</b>	<b>M5 Washer, Steel, Zinc Plated</b>	<b>mcmaster</b>	<b>91166A240</b>	<b>\$0.022</b>	<b>11</b>	<b>ea</b>	<b>\$0.02</b>	<b>6000</b>
Hardware	HD-BT0048	M5 x 10 Bolt, SHCS Black-Oxide	Timberline	8050-0510	\$0.02	6	ea	\$0.13	5000
Hardware	HD-BT0049	M5 x 14 Bolt, SHCS Black_Oxide	Timberline	NOR-M600510145O	\$0.03	3	ea	\$0.16	3000
Hardware	HD-NT0002	M8 Nyloc Nut, Zinc Plated	Timberline	GBO-946270004	\$0.05	9	ea	\$0.11	9100
Hardware	HD-WA0006	M8 Washer, Steel, Zinc Plated	Timberline	8206-0080	\$0.01	1	ea	\$0.05	1000
Hardware	HD-WA0008	Metric Spring Steel Shim - DIN 988 0.5mm Thick, 8mm ID, 14mm OD	Timberline	1	ea	\$0.06	1000	\$0.06	1000
Hardware	HD-WA0009	Metric Spring Steel Shim - DIN 988 1.0mm Thick, 8mm ID, 14mm OD	Timberline	1	ea	\$0.10	2000	\$0.19	2000
Hardware	HD-MS0381	Thumb Screw Knob for M4 SHCS, Black	McMaster	7130k32	\$1.030	2	ea	\$2.06	2020
Hardware	HD-BT0120	Alloy Steel Shoulder Screw, 6mm Diameter x 10mm Long	McMaster	AEH#02-000818-UVB	\$0.02	12	ea	\$0.28	12000
Hardware	HD-MS058	Shoulder, M5 Thread	Timberline	7526k22	\$0.249	2	ea	\$0.50	2050
Hardware	HD-MS0249	Wire Tie, 8"	McMaster	7604A55	\$0.066	0.5	g	\$0.03	5 bottles
Hardware	TL-CS0040	UV-Resistant Cable Tie Holder, Adhesive Back/Screw Mount, 4-Way, for 4.8" Maximum Tie, Blk	McMaster	7604A55	\$0.066	2	ea	\$23.00	2020
Consumable	HD-RB0036	Extreme-Temperature Pipe Sealant & Threadlocker, 4 oz bottle, blue	Thomson	767.80	\$7.50	10	500ml	\$13.56	2050
Mechanical	HD-NT0047	Drive Rod 10mm	MTS10 x 2m	GSASL16-5-5	160	mm	mm	\$0.034	10 rolls
Mechanical	HD-MS0194	10mm x 2mm Flange mount supermount	McMaster	S-139394	160	mm	mm	\$0.78	51 rolls
Mechanical	HD-MS0255	Coupling, Set Screw, Misumi GSASL16-5-5	Professional Plastics	5279	1	ea	\$1.65	\$1.65	1010
Mechanical	HD-MS0254	Ultim PEI 0.010" x 12" x 30ft rolls	Uline	QTK21007-06	1	ea	\$1.05	\$1.05	1010
Electrical	EL-CA0030	S-139394 3M 468MP Adhesive Transfer Tape - 12" x 60 yards	Ba Monoprice	161-PF003063	1	ea	\$3.16	\$3.16	1010
Electrical	EL-CA0001	6t 18AWG Power Cord Cable w/ 3 Conductor PC Power Connector Socket (C1345-1SP) – Blk	Heilind	576-023007.MXP	2	ea	\$0.45	\$0.89	2050
Electronics	PP-MP0028	6ft USB 2.0 A-Male to B Male 28/24AWG Cable	Mooser	602-29561-100-03	185	mm	mm	\$0.00	8 rolls
Electronics	EL-MS0096	AC Power Entry Modules SC MT FUSED 25' TAB	Mooser	879-1327G5-BK	2	ea	\$0.16	\$0.32	2050
Electronics	EL-WP0240	Cartridge Fuses 125V 7A 6X20 MA ULBC	National Plastic Heater	879-1332-BK	2	ea	\$0.10	\$0.20	2050
Electronics	EL-MS0098	Wire - Single Conductor 20AWG SOLID PTFE, RED	Peltons	KLT08	1	ea	\$27.95	\$27.95	On Order
Electronics	EL-MS0010	Heavy Duty Power Connectors POWERPOL 15A CONT	Digkey	EG1535-ND	1	ea	\$6.68	\$6.68	1050
Electronics	PC-BD0029	Silicon Heater, 24V, 168mm x 168mm, Self Adhesive, w/ connectors	Changzhou FTX Motors Cr	SY425TH7-1504A	5	ea	\$1.70	\$1.70	1100
Electronics	EL-FP0020	RFB200 Micro flower	UltiMachine vbx.com	\$7.00	1020	On Order	\$7.50	\$7.50	On Order
Electronics	EL-SW0023	SWITCH H ROCKER DPST 20A 250V, illuminated red	Shipper's Supply	20140922SA	1	ea	\$7.00	\$7.00	11000
Electronics	EL-MT0001	NEEMA 17 Stepper Motors	Shipper's Supply	0.018	pc	\$6.95	ea	\$0.14	\$0.14
Electronics	PC-BB0049	NEEMA 17 Stepper Motors	Minerva	1	ea	\$0.01	ea	\$0.01	\$0.01
Mechanical	HD-MS0204	PC-BB0049, assembled board only with no LCD headers	Sealed Skateboardline/Rollerblade Skate Bearing Ball Bearings	1	ea	\$0.03	ea	\$0.03	\$0.03
Etching	PP-FP0058	Sealed Skateboardline/Rollerblade Skate Bearing Ball Bearings	Laser Engraving Designs	1	ea	\$0.02	ea	\$0.02	\$0.02
Packaging	SH-PG0075	1.5# RECYCLING	SH+PG0075	1	ea	\$0.29	ea	\$0.29	\$0.29
Packaging	SH-PG0076	22x17x4.275ft dw/ OUTSIDE PRINT 2 COLOR	9 x 12" 3.1 Mil Uline Clear Carton Sealing Tape 24 rolls/case	1	ea	\$0.18	ea	\$0.18	\$0.18
Packaging	SH-PG0085	3" x 55 yards 3.1 Mil Uline Clear Carton Sealing Tape 24 rolls/case	Label Label/Mini Barcode	1	ea	\$0.24	ea	\$0.24	\$0.24
Packaging	DC-LB0028	Label Label/Mini Barcode	Min 1/1 serial number sticker	1	ea	\$0.14	ea	\$0.14	\$0.14
Packaging	DC-LB0029	HIPS, 1 meier Sample, Random Color	HIPS, 1 meier Sample, Random Color	1	ea	\$0.01	ea	\$0.01	\$0.01
Packaging	RW-HB0024	3 x 4" 2 MIL Redlosable Polypropylene Bags	3 x 4" 2 MIL Redlosable Polypropylene Bags	1	ea	\$0.03	ea	\$0.03	\$0.03
Packaging	SH-PG0002	9 x 12" 3 MIL Reclosable Bags	9 x 12" 3 MIL Reclosable Bags	1	ea	\$0.02	ea	\$0.02	\$0.02
Packaging	SH-PG0083	6 x 10" 6 MIL Reclosable Bags	6 x 10" 6 MIL Reclosable Bags	1	ea	\$1.15	ea	\$1.15	\$4.15
Packaging	SH-PG0084	Packing List, Mini 1.0	Packing List, Mini 1.0	1	ea	\$1.87	ea	\$1.87	\$1.87
Packaging	DC-M50028	Quality Assurance Record Mini 1.0	GORDON BRUSH MFCC	906501	1	ea	\$0.72	\$0.72	1020
Packaging	DC-M50029	.003 Staples, Steel/Straight Instrument Cleaner Brush	USB Memory Direct	1	ea	\$5.20	ea	\$5.20	\$5.20
Tools	TL-MS0020	SWM Style USB Flash drive, 4gb, black	Image Supply	(DP-19) M SV	1	ea	\$4.15	\$4.15	1020
Tools	EL-NS0046	Pro Dental Pick, 5 3/4 in	WEBstaurant Store	35340592	1	ea	\$2.03	\$2.03	1010
Tools	TL-HD0009	7 1/2" Nylon Handle Clam Knife							

Total Lutz  
\$732.61

1.00 Needs something

Good to Order

Ordered

## 2.3 Begonia Renders

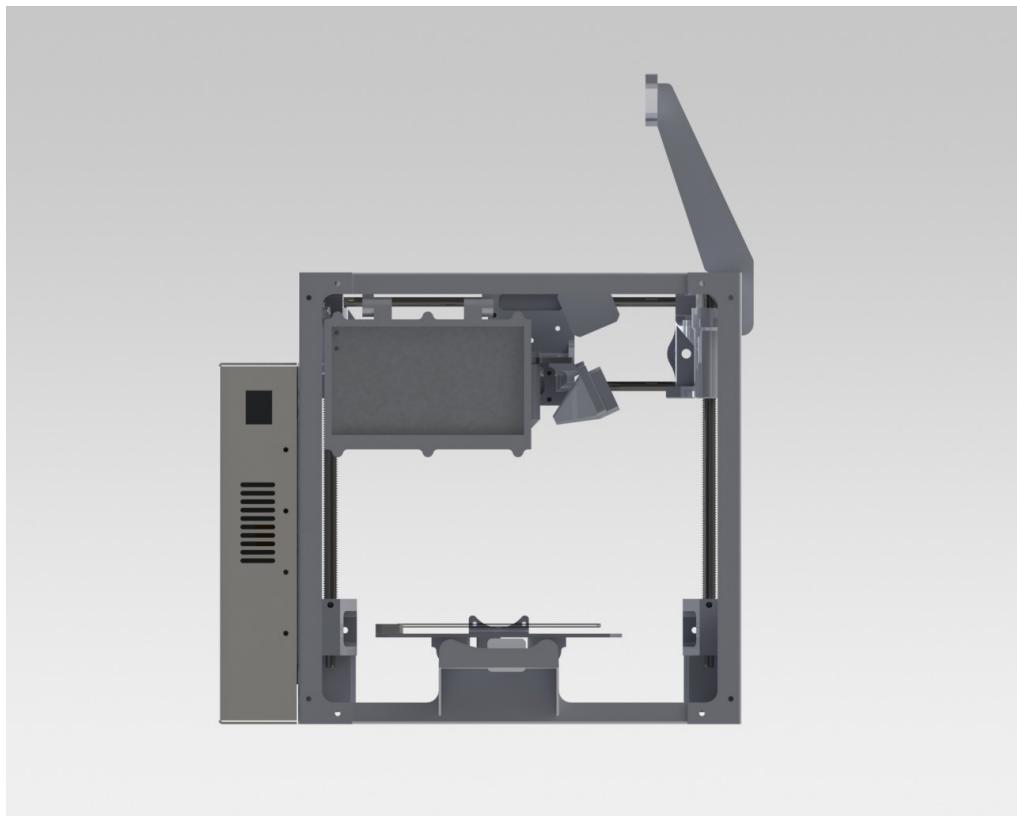


Figure 2.2: Begonia Front Render

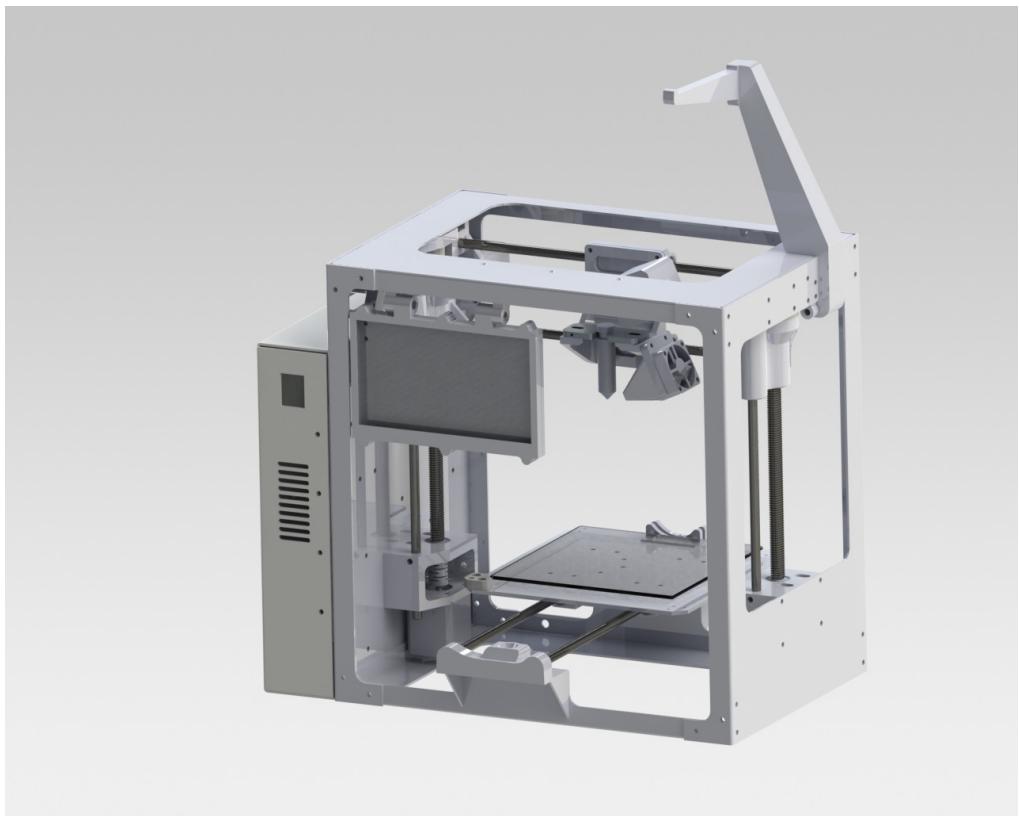


Figure 2.3: Begonia ISO Render

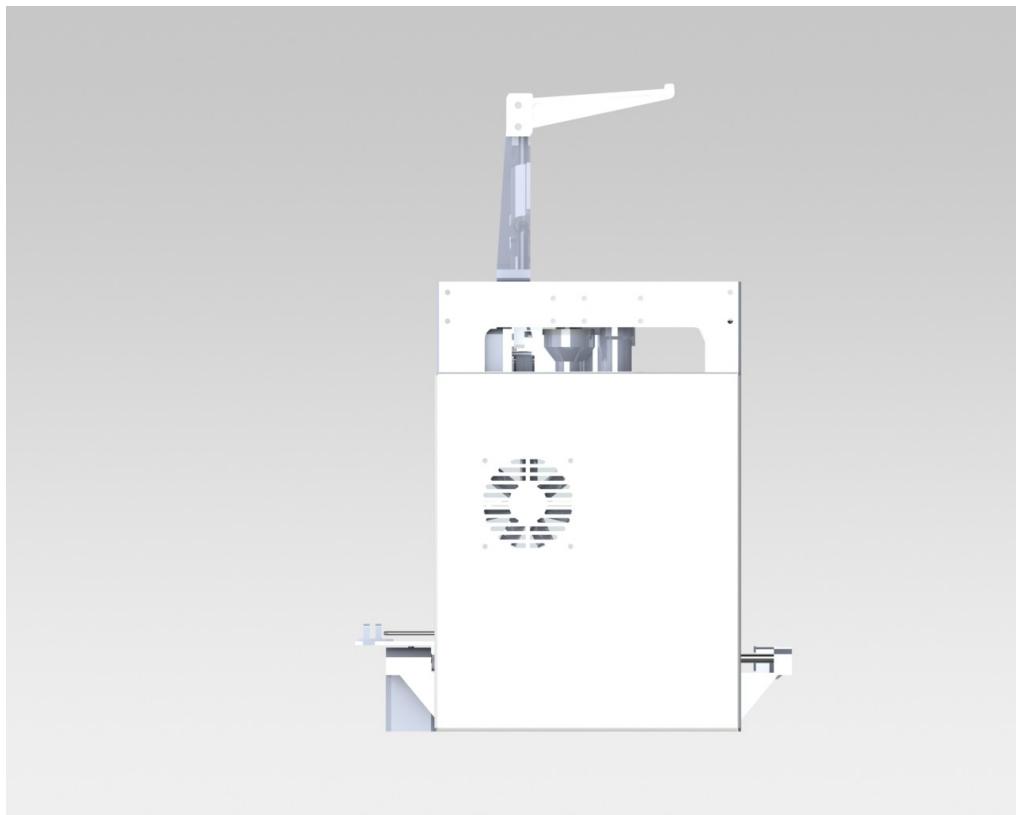


Figure 2.4: Begonia Left Render

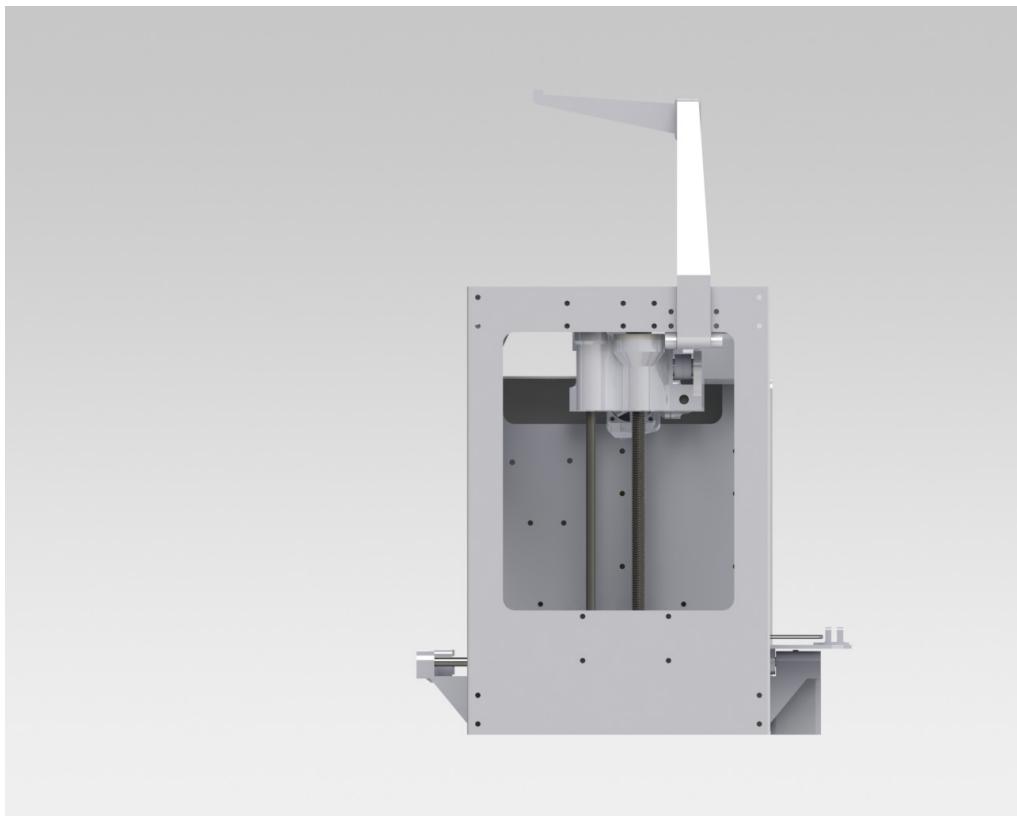


Figure 2.5: Begonia Right Render

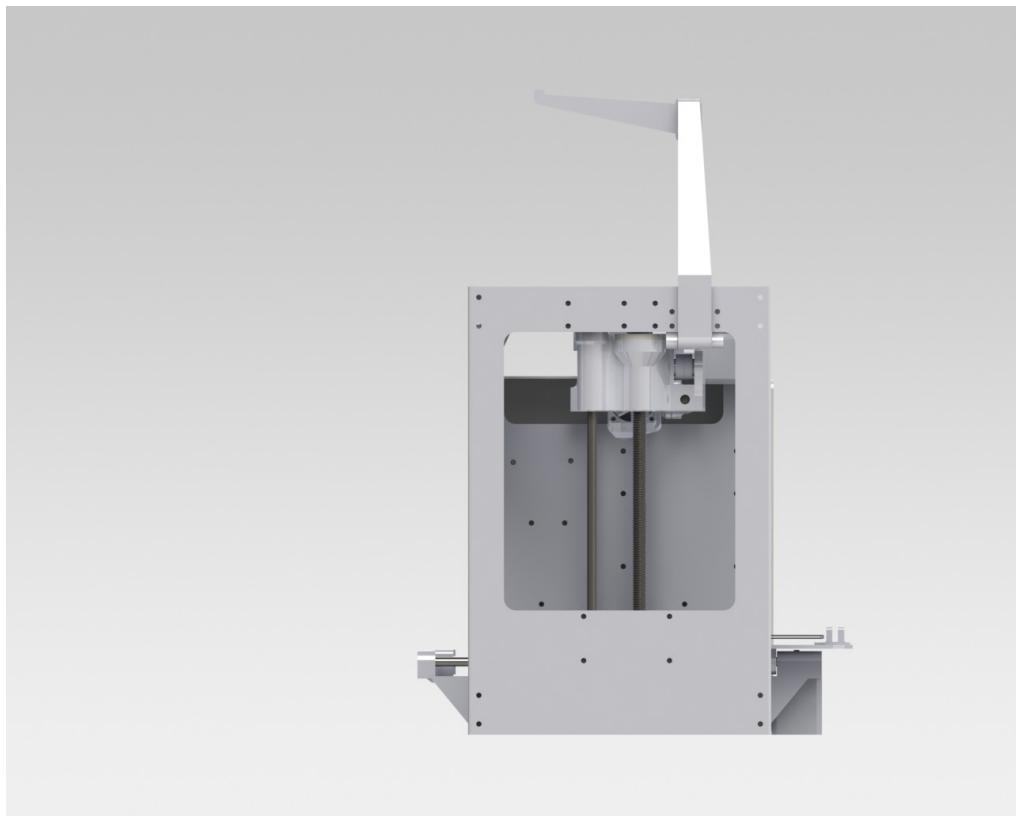


Figure 2.6: Begonia Right Render

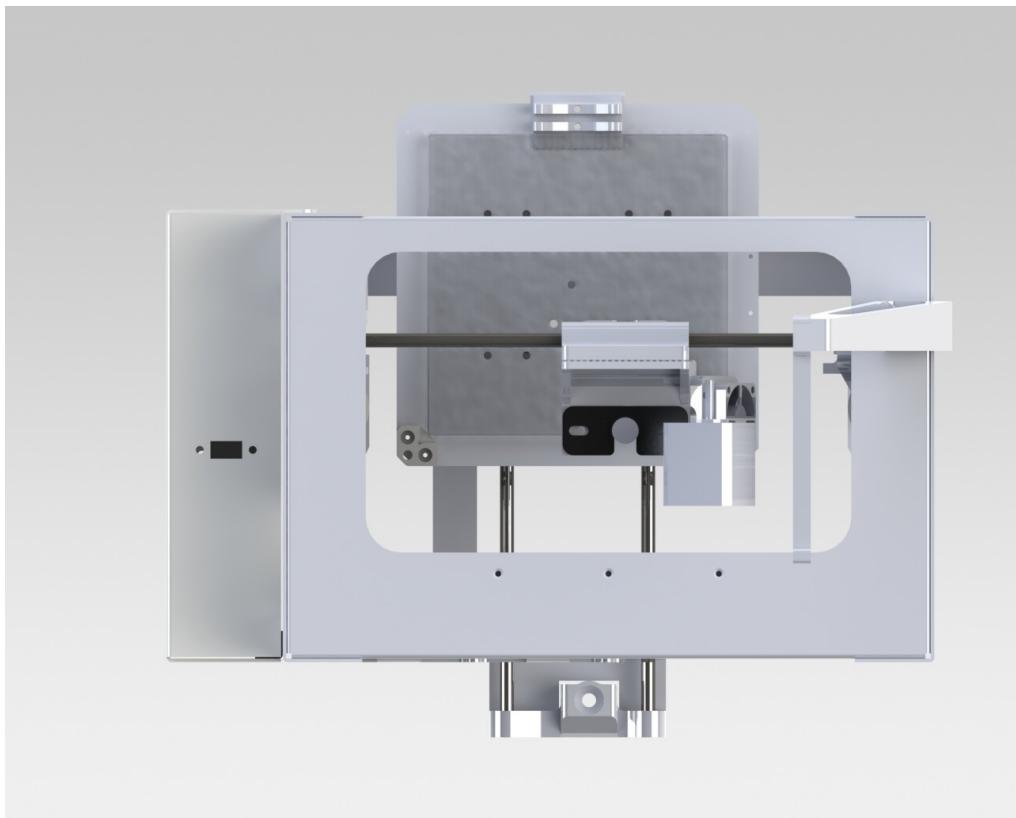


Figure 2.7: Begonia Top Render

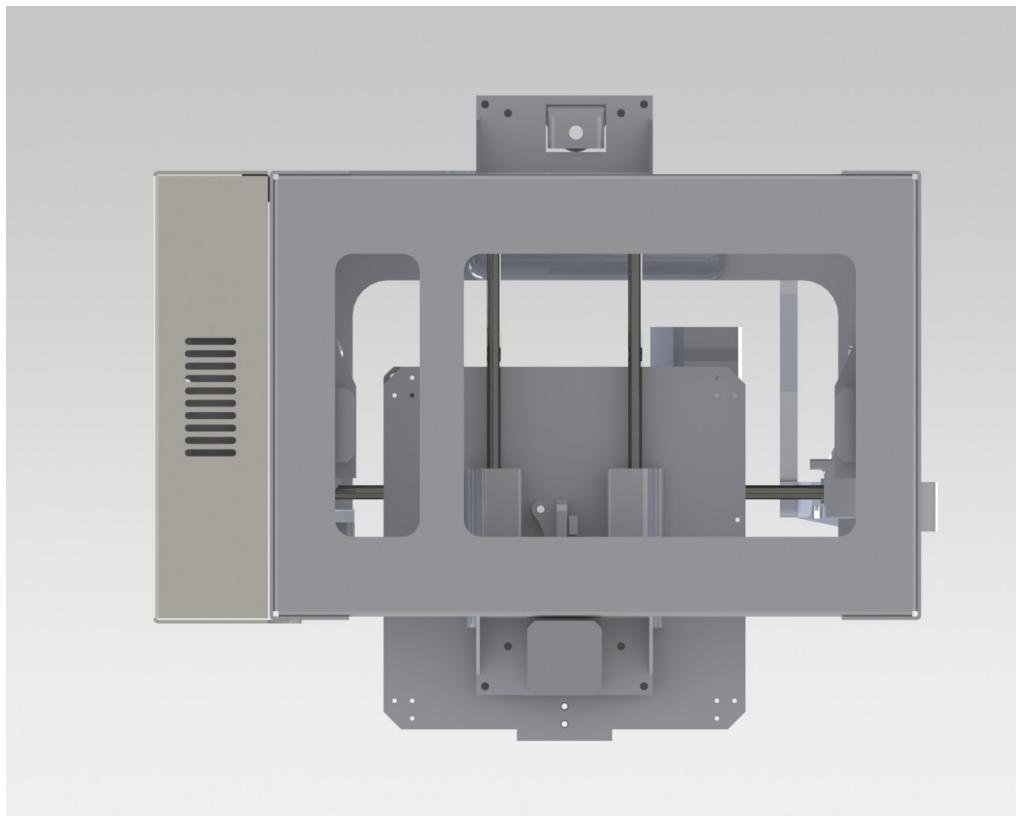


Figure 2.8: Begonia Bottom Render

## 2.4 Begonia 3D Printed Parts

## 2.5 Begonia Bed

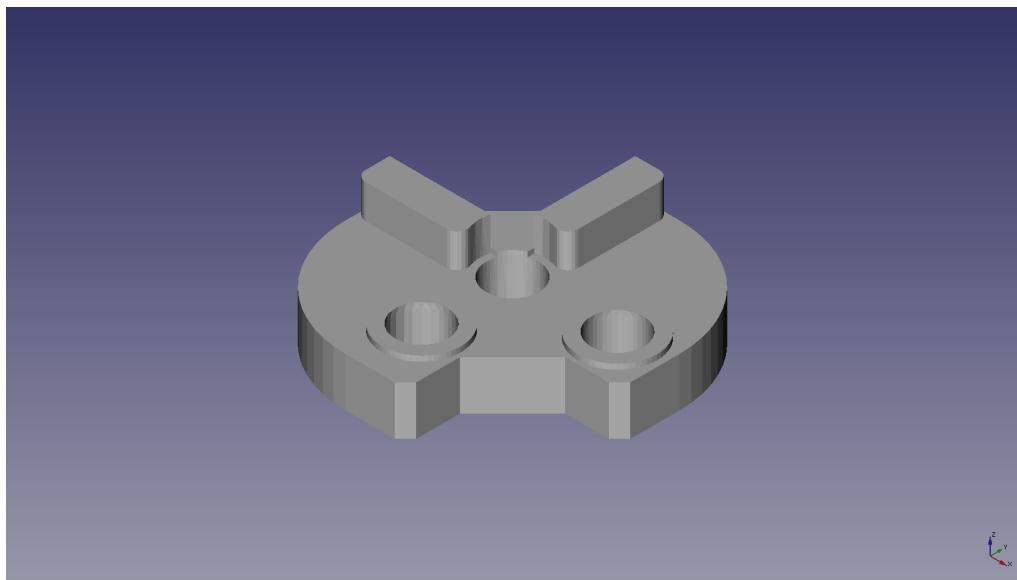


Figure 2.9: Begonia 3D Printed Bed Corner Render

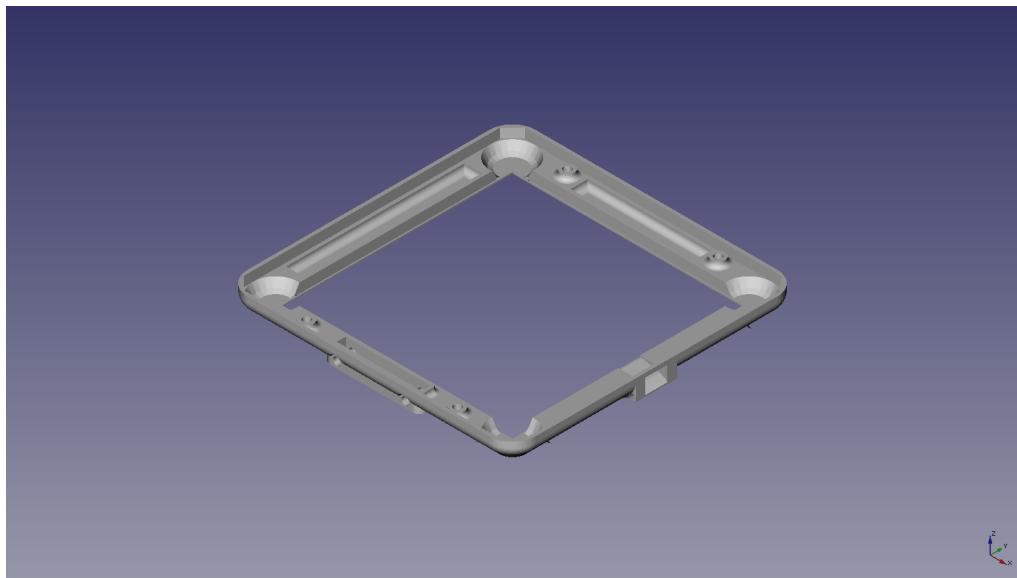


Figure 2.10: Begonia 3D Printed Bed Cover Render

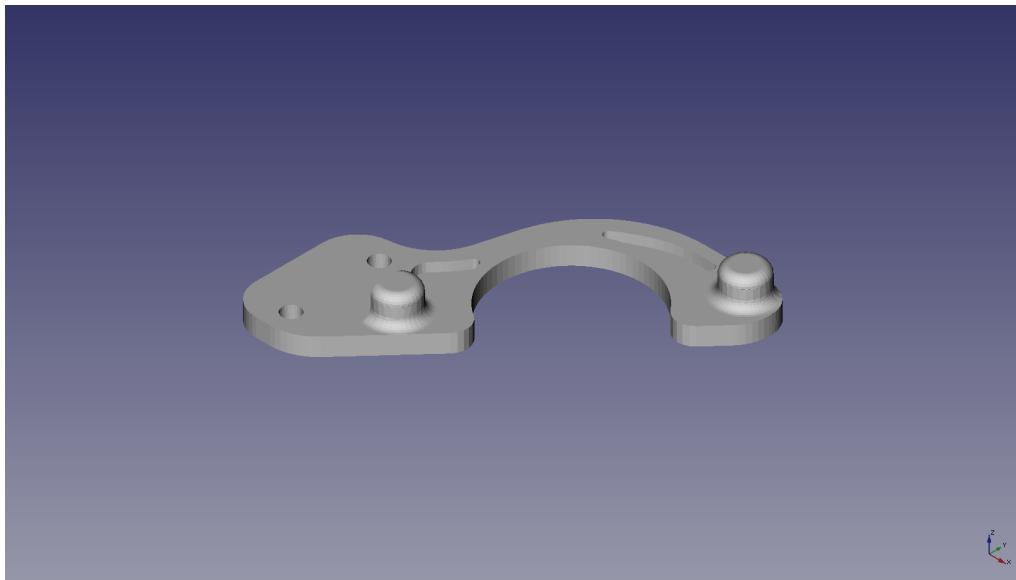


Figure 2.11: Begonia 3D Printed Bed Fan Mount Render

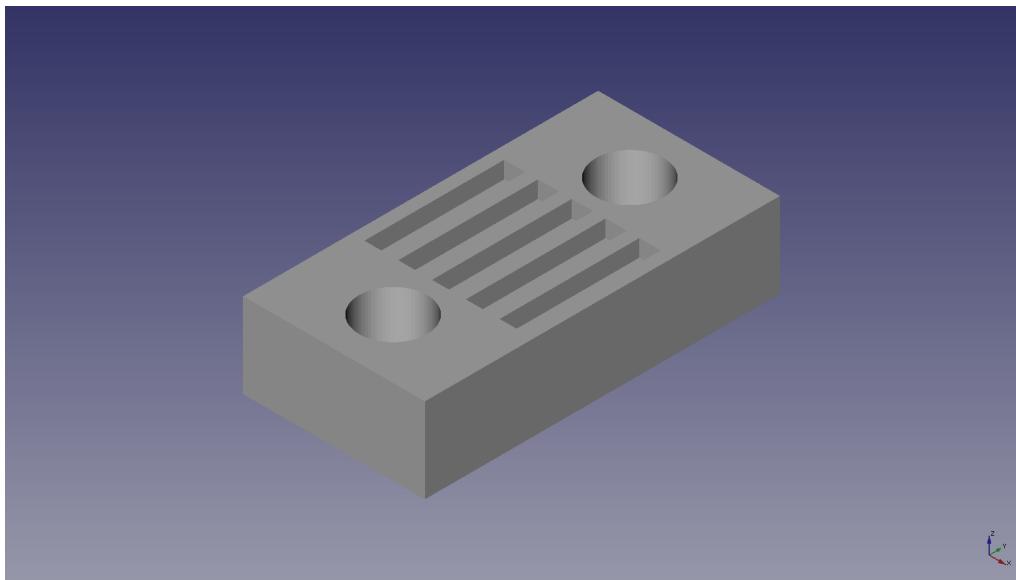


Figure 2.12: Begonia 3D Printed Belt Clamp Render

## 2.6. BEGONIA EXTRUDER

### 2.6 Begonia Extruder

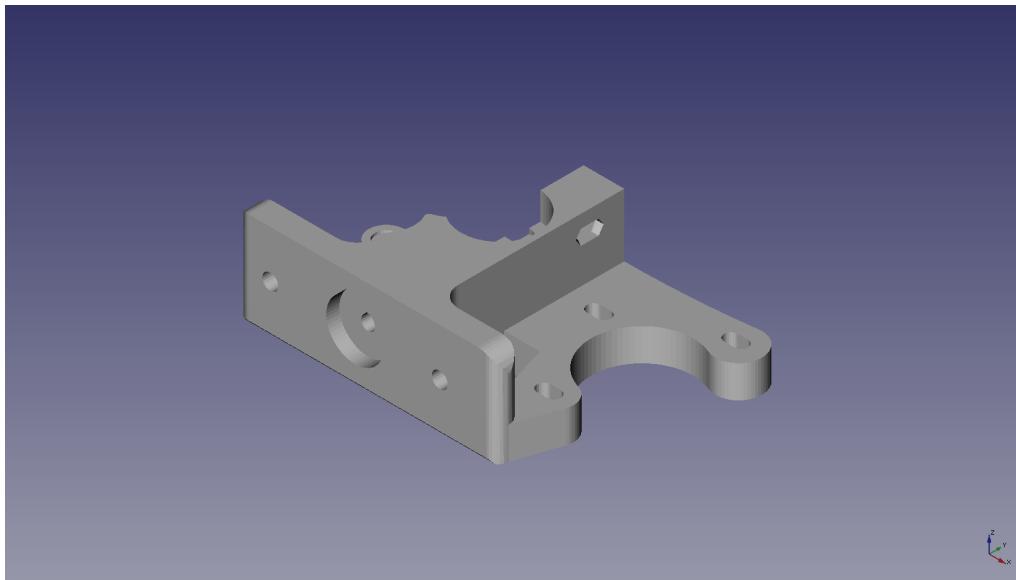


Figure 2.13: Begonia 3D Printed Extruder Body Hex Render

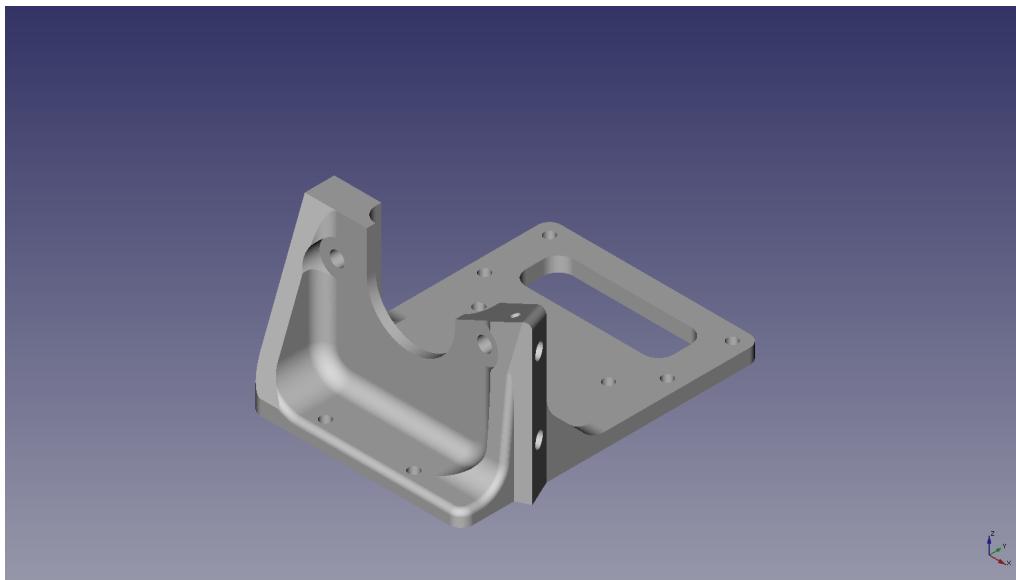


Figure 2.14: Begonia 3D Printed Extruder Mount Render

## 2.7 Begonia LCD

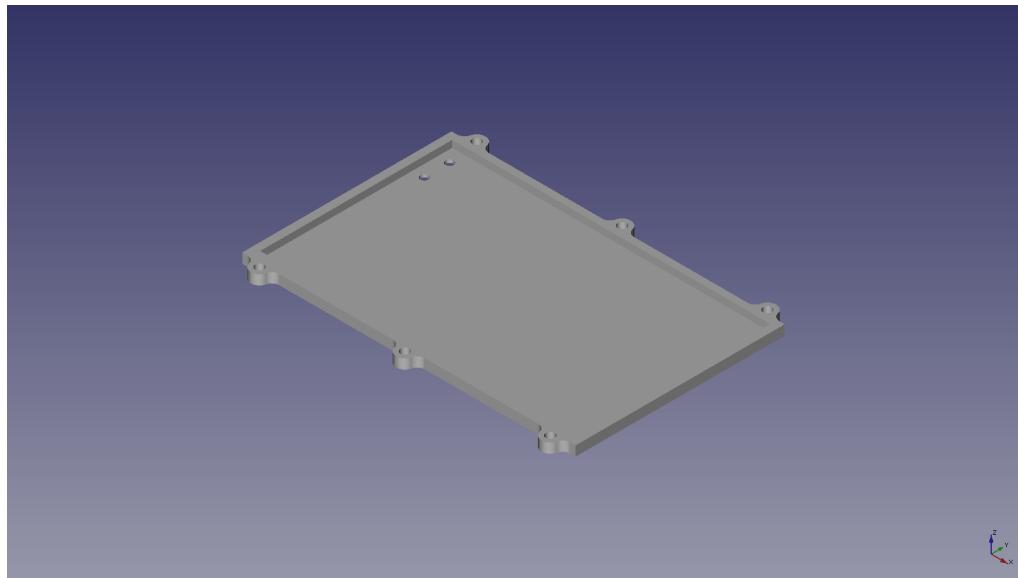


Figure 2.15: Begonia 3D Printed LCD Back Cover Render

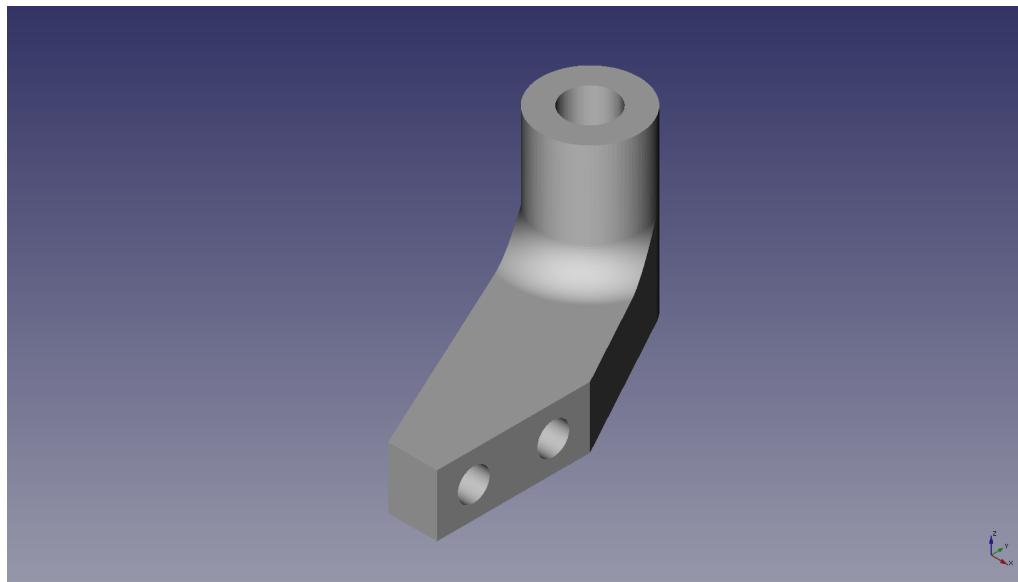


Figure 2.16: Begonia 3D Printed LCD Catch Render

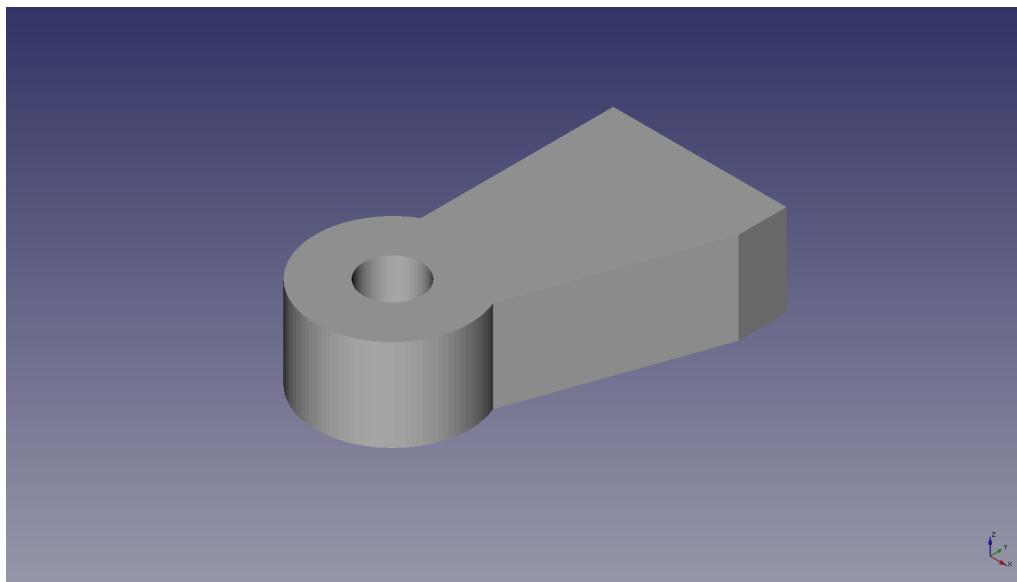


Figure 2.17: Begonia 3D Printed LCD Hinge Render

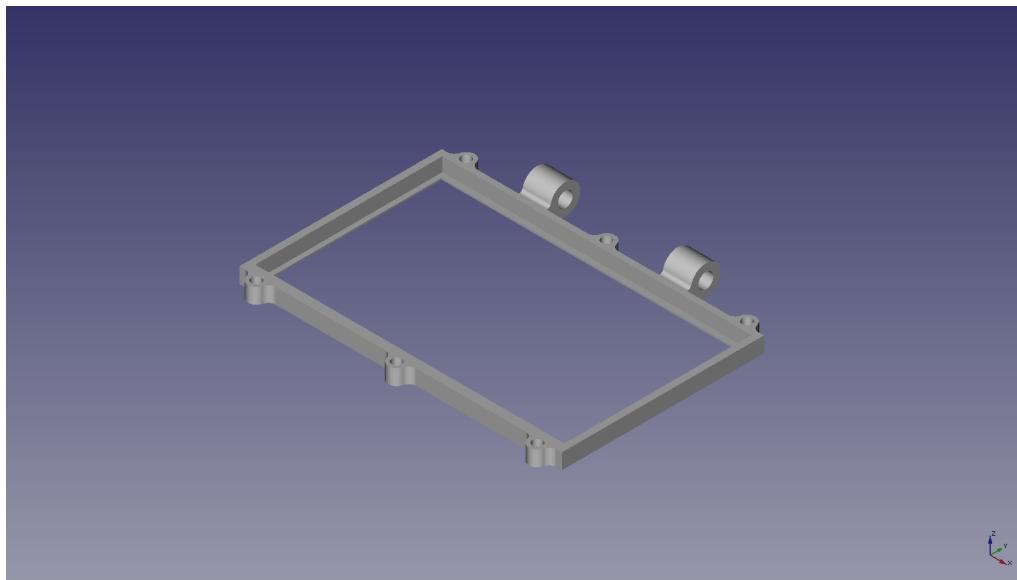


Figure 2.18: Begonia 3D Printed LCD Mount Render

## 2.8 Begonia Spool

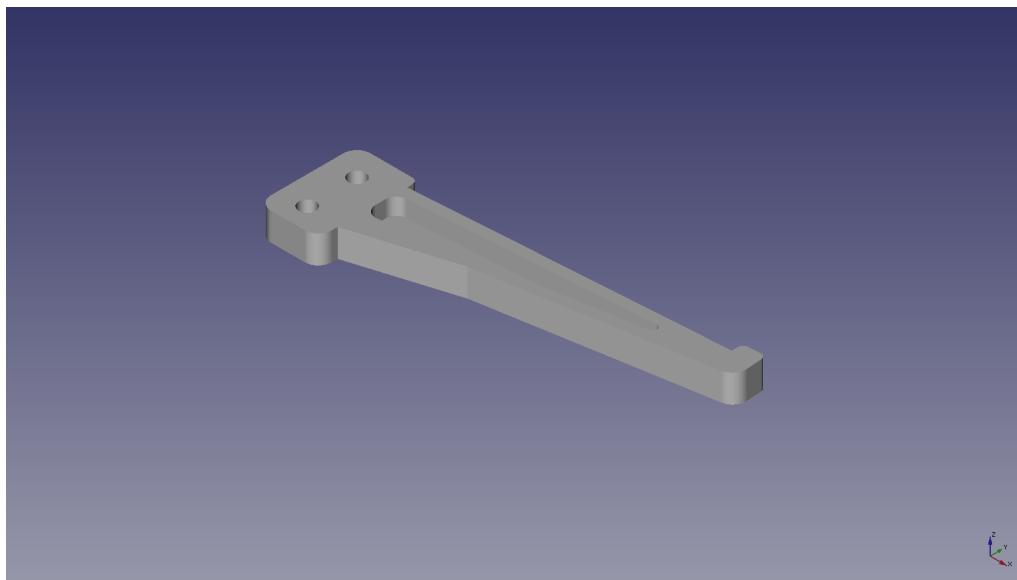


Figure 2.19: Begonia 3D Printed Spool Arm Render

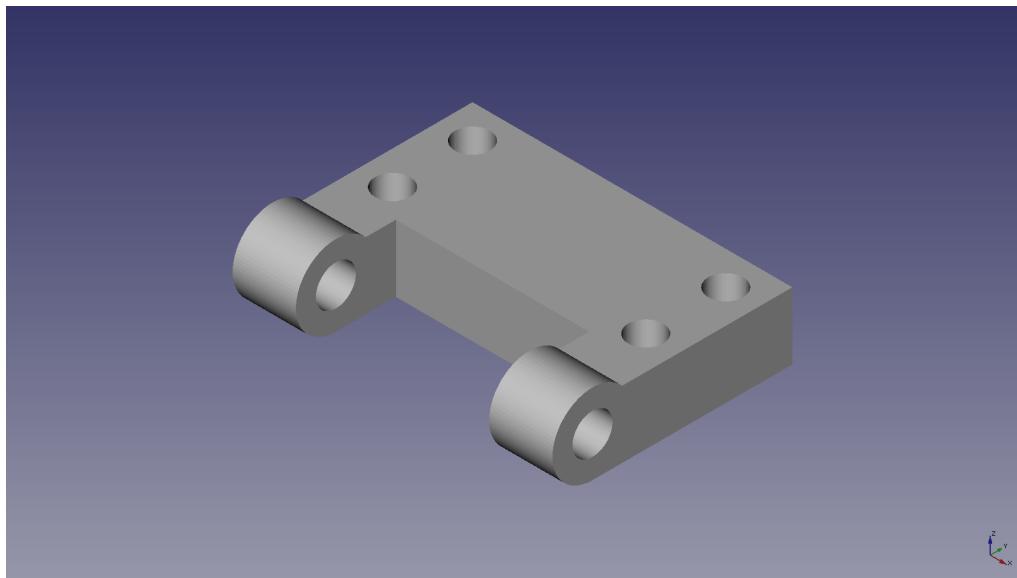


Figure 2.20: Begonia 3D Printed Spool Hinge Render

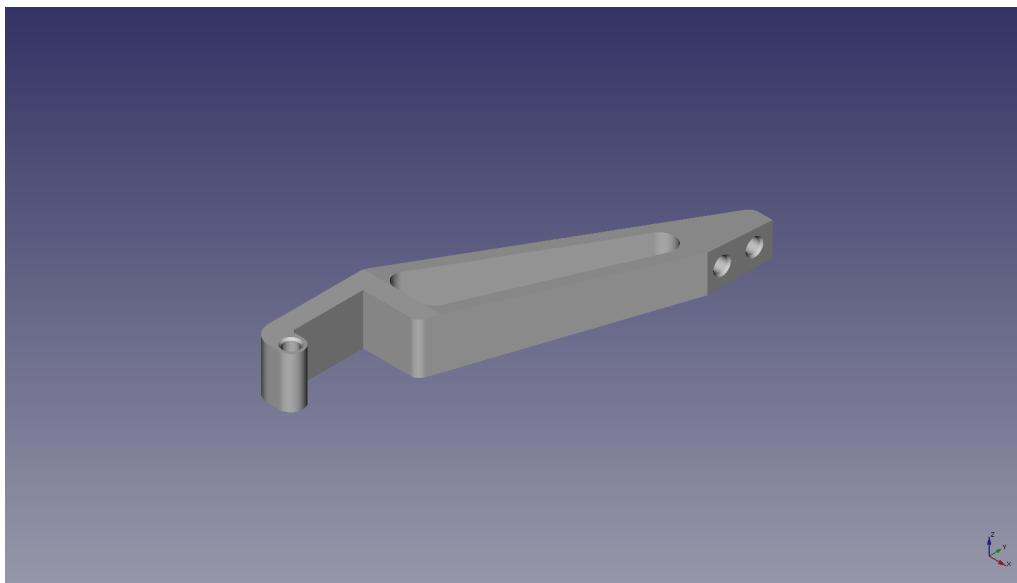


Figure 2.21: Begonia 3D Printed Spool Mount Render

## 2.9 Begonia X

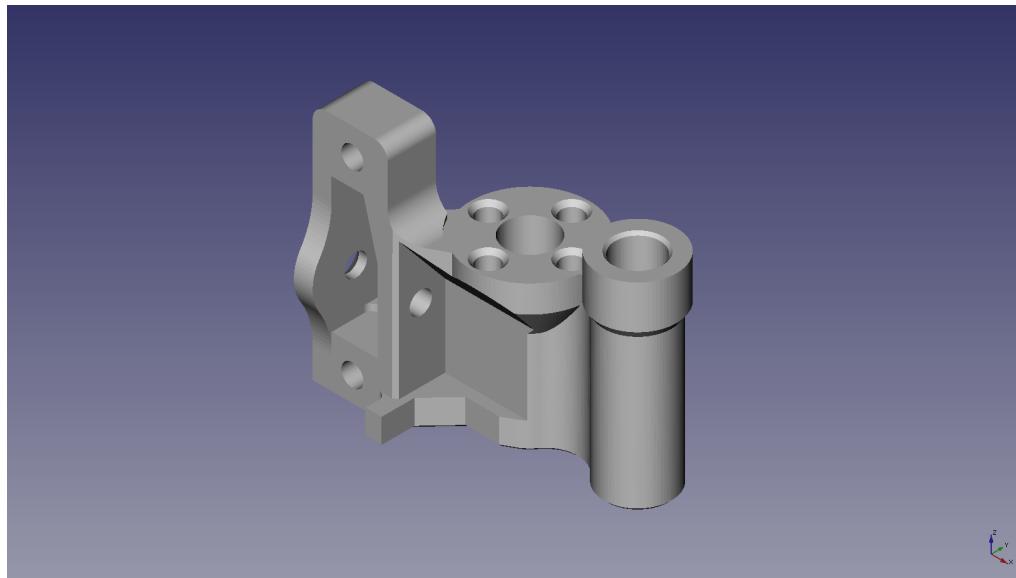


Figure 2.22: Begonia 3D Printed X End Idler Render

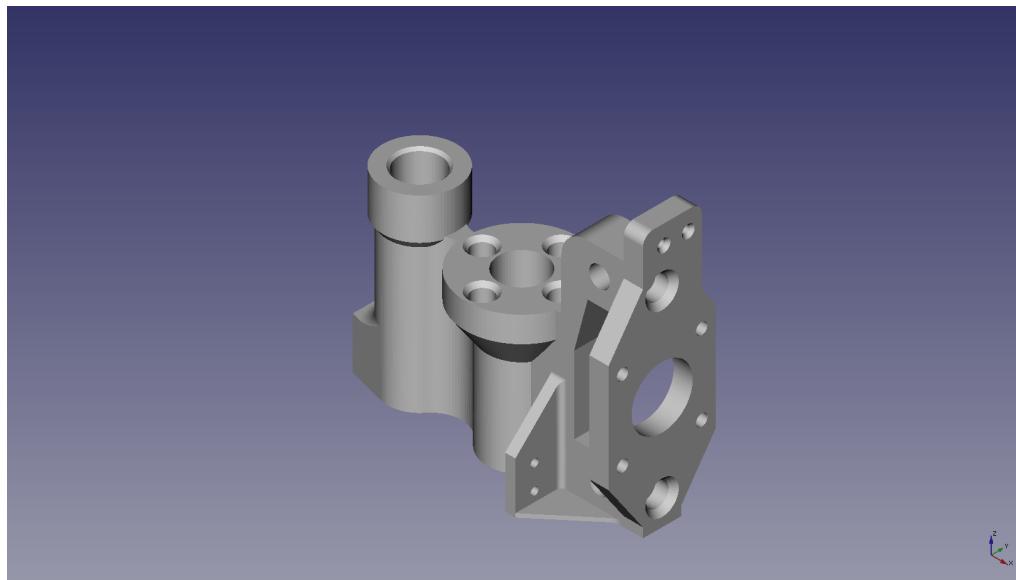


Figure 2.23: Begonia 3D Printed X End Motor Render

## 2.10 Begonia Y

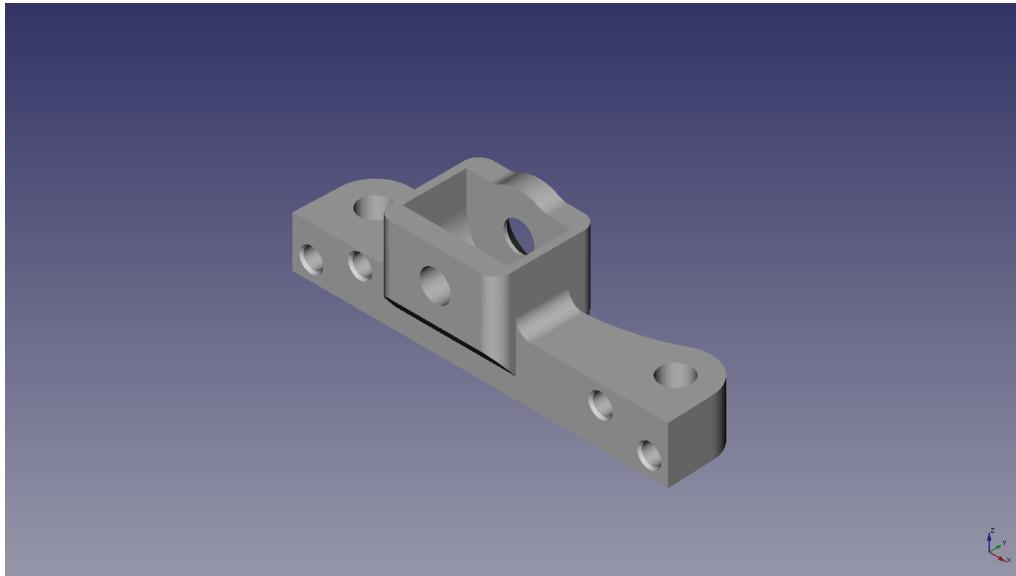


Figure 2.24: Begonia 3D Printed Y End Idler Render

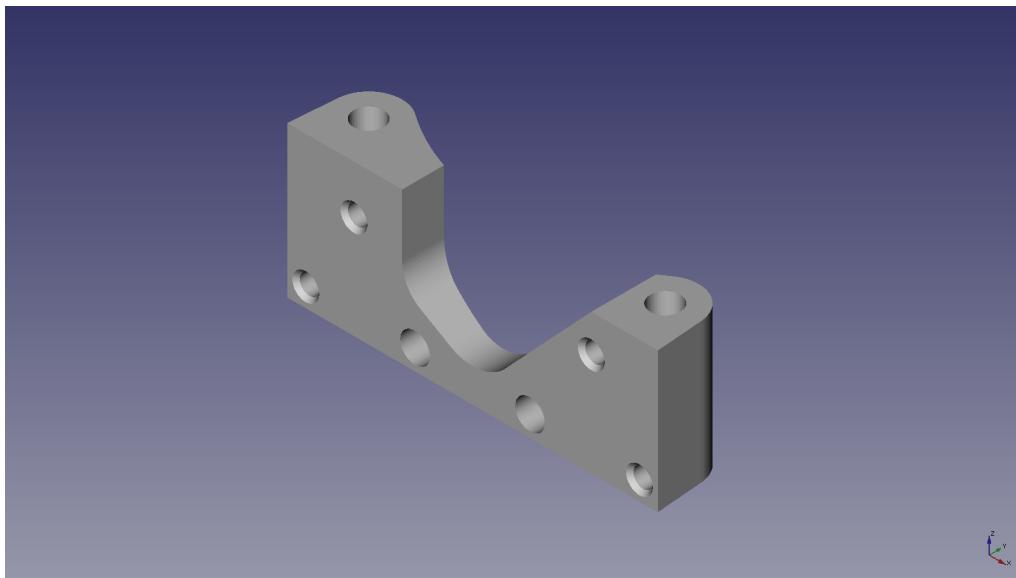


Figure 2.25: Begonia 3D Printed Y Rod Mount Render

## 2.11 Begonia Z

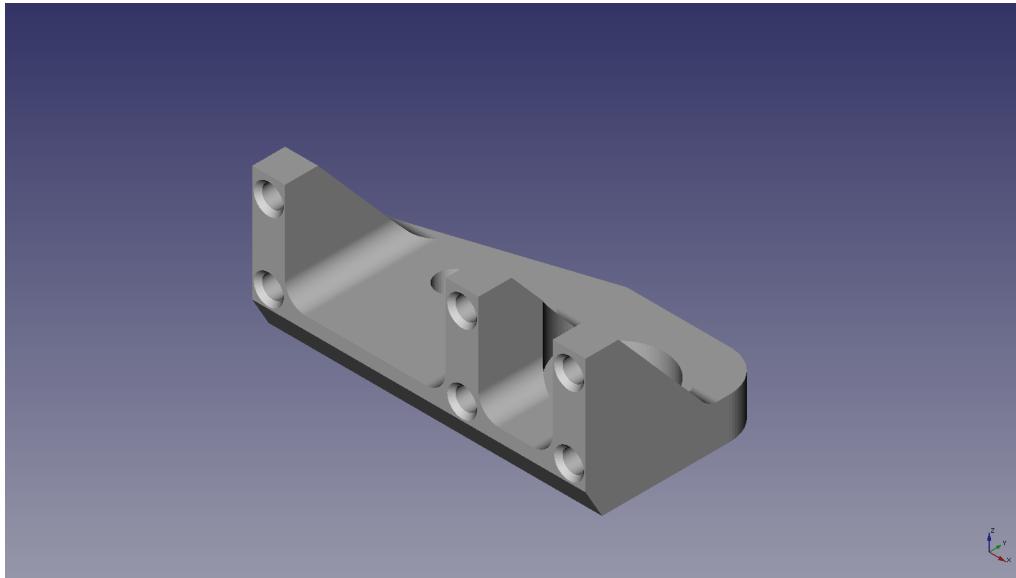


Figure 2.26: Begonia 3D Printed Upper Z Left Render

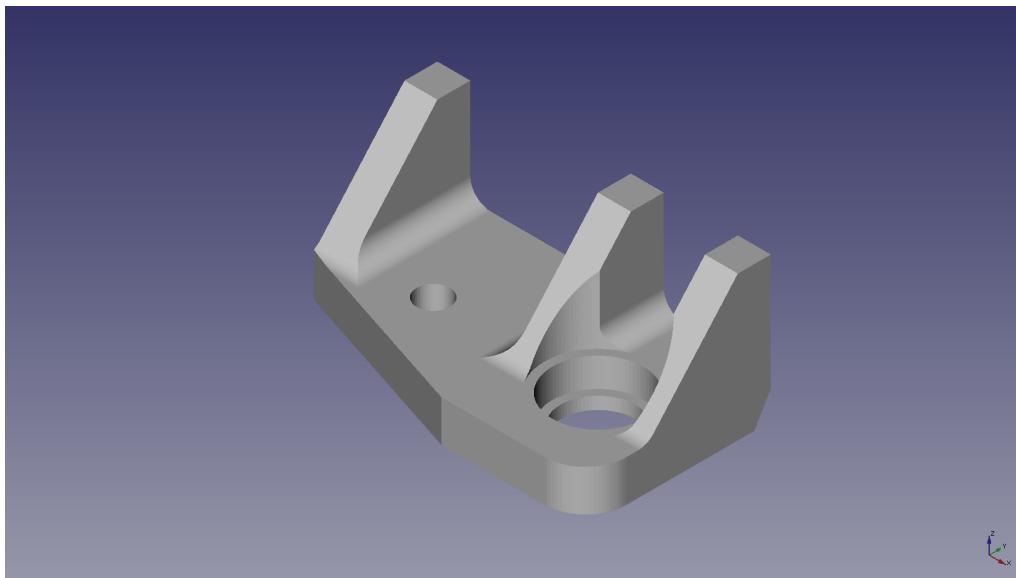


Figure 2.27: Begonia 3D Printed Upper Z Right Render

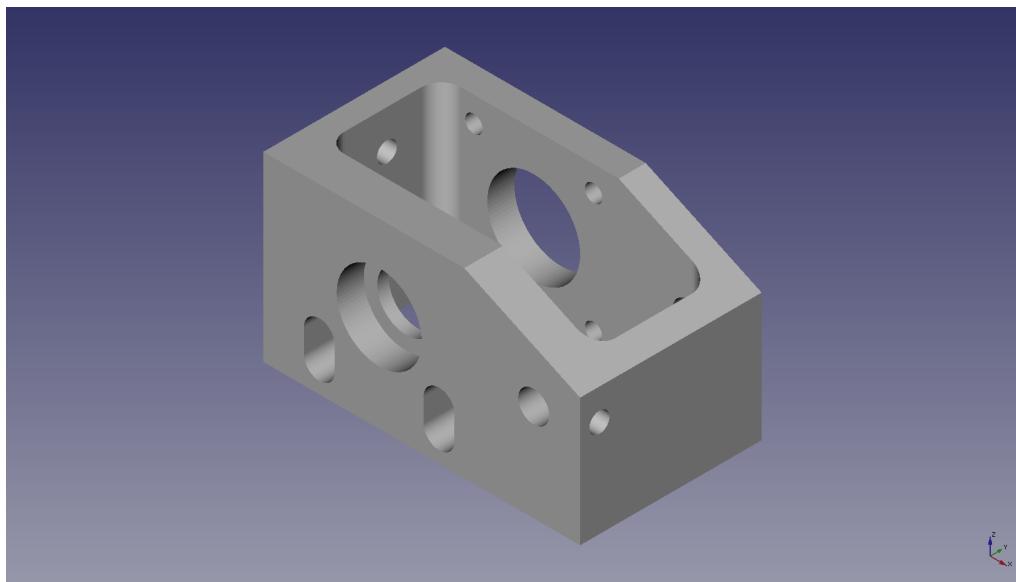


Figure 2.28: Begonia 3D Printed Lower Z Left Render

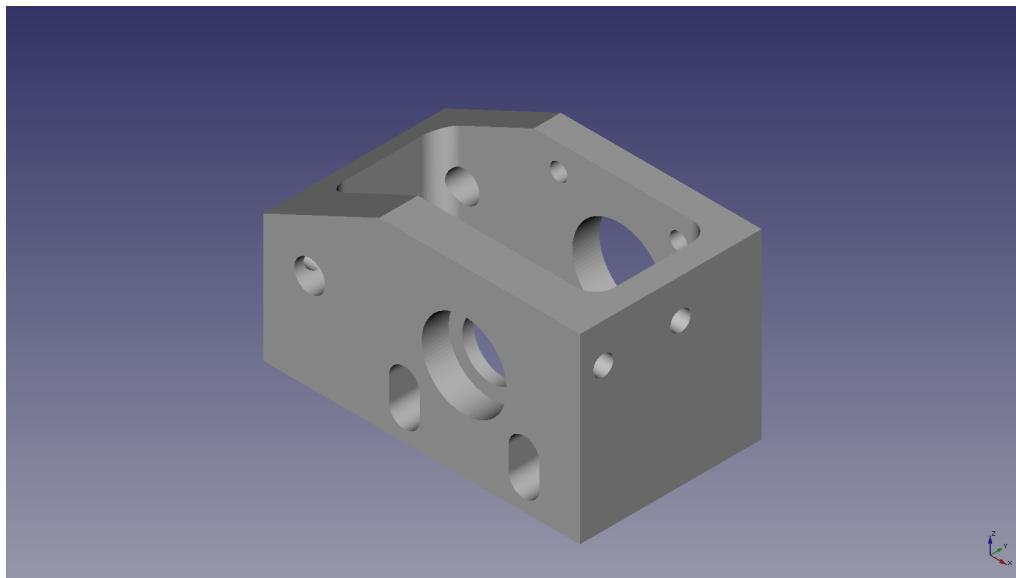


Figure 2.29: Begonia 3D Printed Lower Z Right Render

## 2.12 Begonia Misc

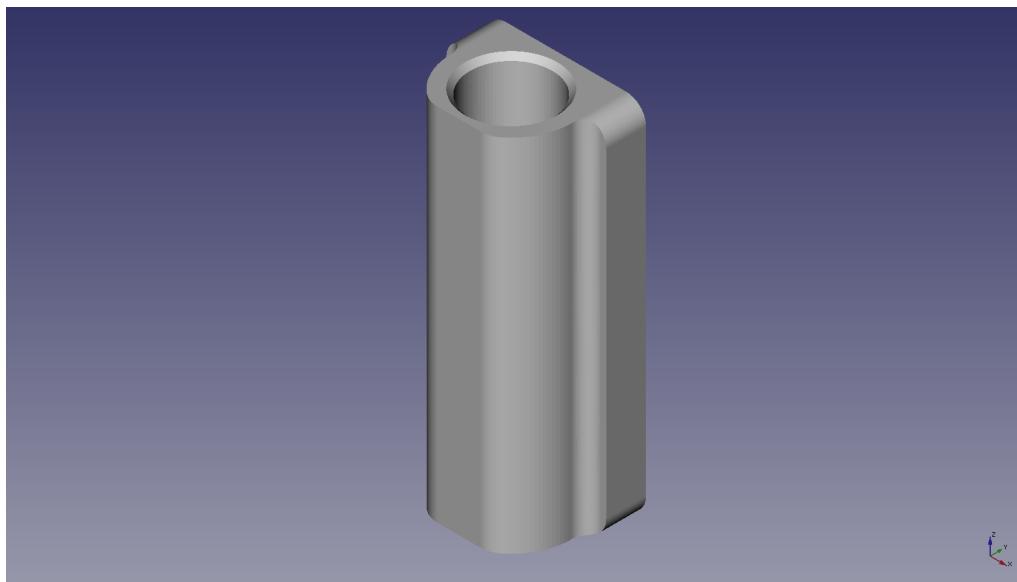


Figure 2.30: Begonia 3D Printed Double Bearing Holder Render

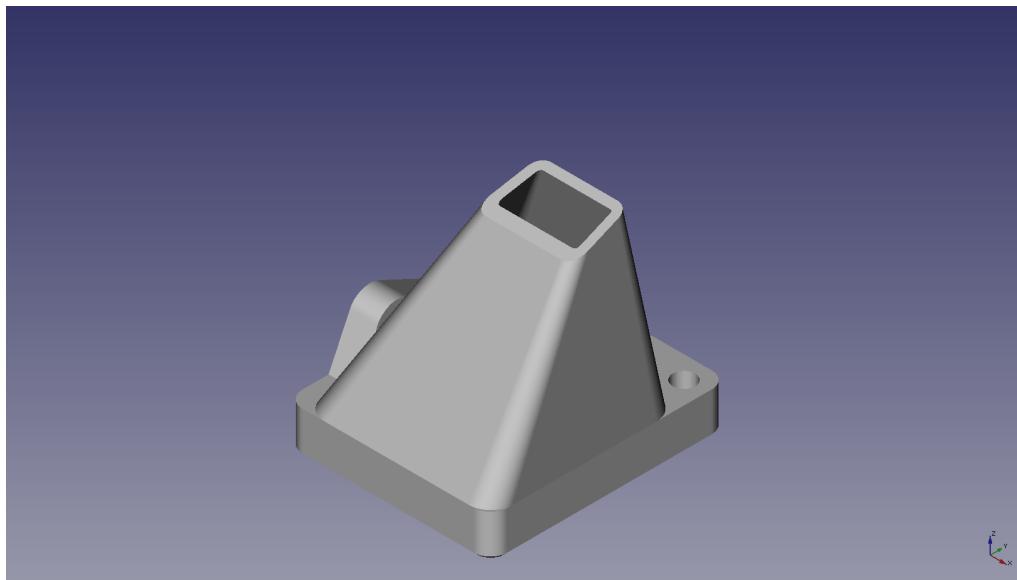


Figure 2.31: Begonia 3D Printed Fan Mount Render

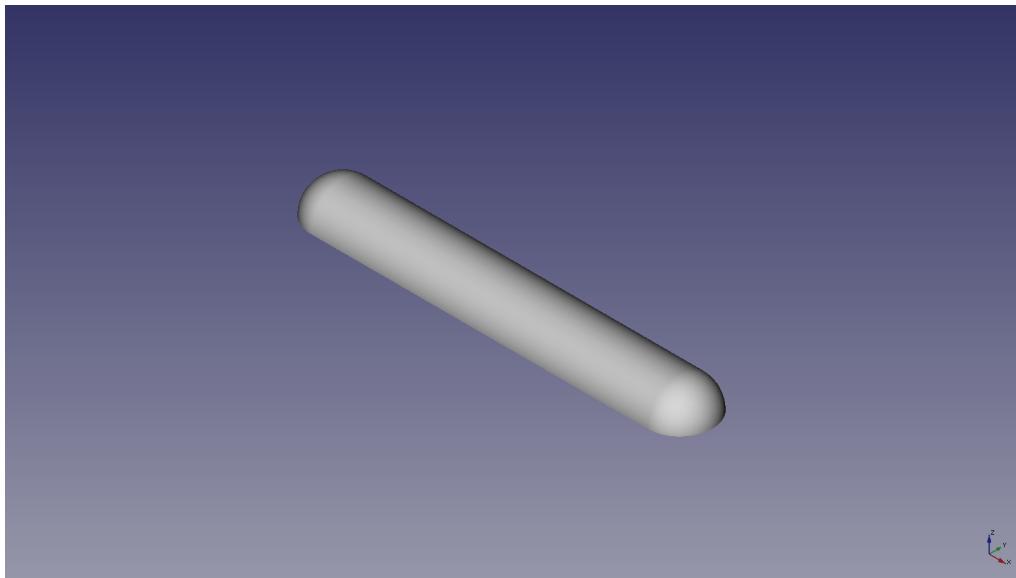


Figure 2.32: Begonia 3D Printed Handle Bar Render

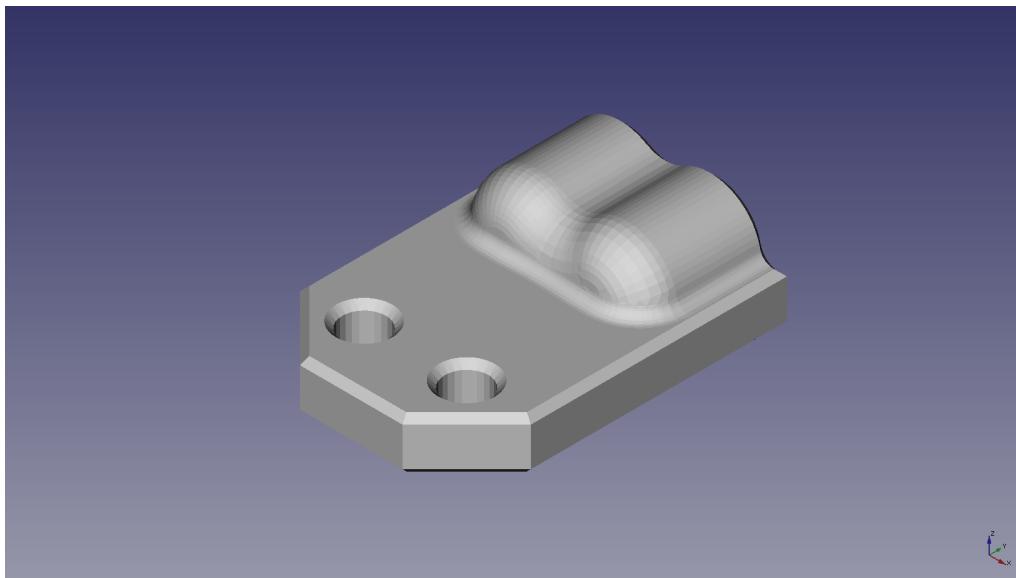


Figure 2.33: Begonia 3D Printed Cable Carrier Mount Render

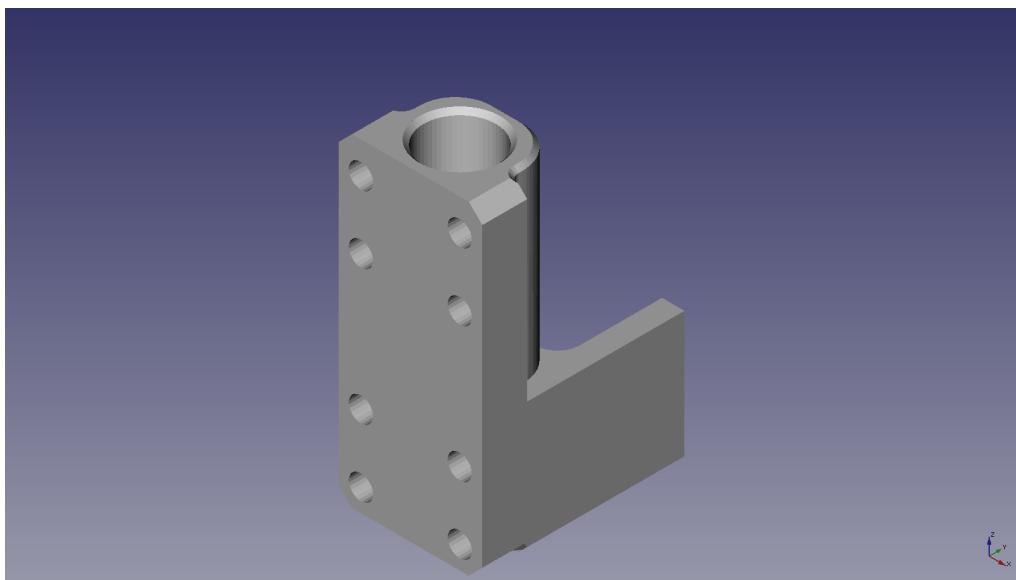


Figure 2.34: Begonia 3D Printed Extruder Mt Top Double Bearing Holder Render

2.13 Begonia Drawings

2.14 Camillia Drawings

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## **Electrical**

## **Power Supply, wiring**

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### 3.1 Electrical Layout

---

**3D Printer Controller**

**Mini-RAMBo**

---

## 4.1 Intro

The printer controller will be the RAMBo-Mini.

---

**Packing**

**If It Shakes It Breaks**

---

## 5.1 Intro

Pack it well.



# PACKING LIST

Model: LulzBot Mini 1.0 3D Printer

Serial Number: \_\_\_\_\_

Date Completed: \_\_\_\_\_

Completed by: \_\_\_\_\_

## Items to include:

### Printer and Cables:

- LulzBot Mini 1.0 3D printer
- 6ft 18AWG Power Cord Cable (5279)
- 6ft 18AWG England Power Cord Cable (7691) (If applicable)
- 6ft 18AWG European Power Cord Cable (7692) (If applicable)
- USB cable

### Supplies:

- USB drive with source files
- 3 meter sample of LulzBot HIPS 3D printer filament
- Dental pick
- Brush
- Clam knife
- 5x replacement wiping pads

### Final Print:

- Rocktopus\* printed by this LulzBot Mini 3D Printer

### Documentation:

- Quick Start Guide
- Quality Assurance Record document
- Packing List document



Aleph Objects, Inc.  
626 West 66th Street  
Loveland, Colorado 80538 USA

[www.alephobjects.com](http://www.alephobjects.com)  
[www.lulzbot.com](http://www.lulzbot.com)  
+1-970-377-1111



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## Contact

### Phone, Email, Web, Location

---

## 6.1 Support

Email: [support@alephobjects.com](mailto:support@alephobjects.com)

Phone: +1-970-377-1111 x610

LulzBot Forum

<http://forum.lulzbot.com>

## 6.2 Sales

Email: [sales@alephobjects.com](mailto:sales@alephobjects.com)

Phone: +1-970-377-1111 x600

## 6.3 Websites

Aleph Objects, Inc.

<http://www.alephobjects.com>

LulzBot 3D Printers

<http://www.lulzbot.com>



# Colophon

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Created with 100% Free Software

GNU/Linux

$\text{\LaTeX}$  Memoir

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