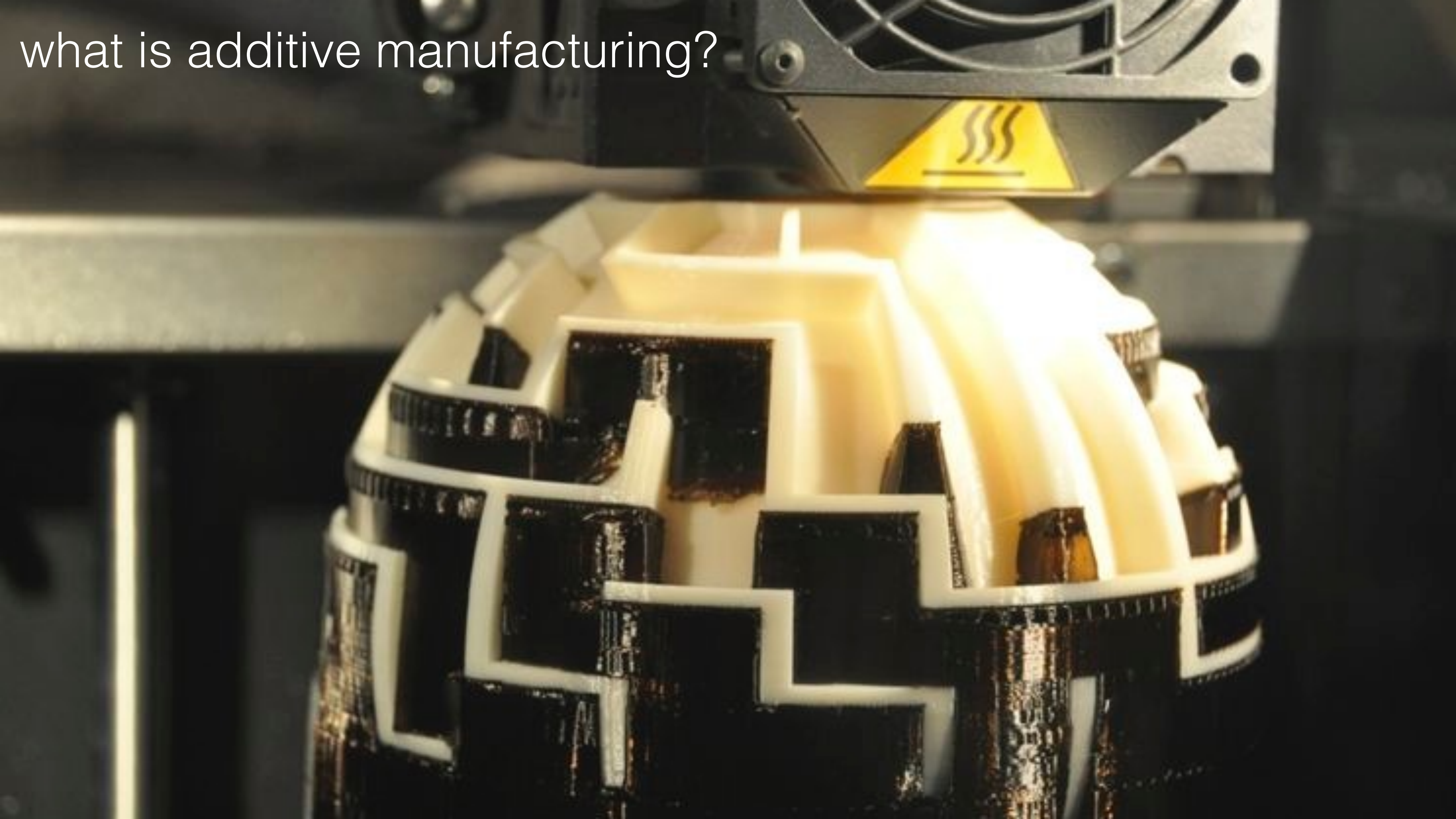


# Additive Manufacturing



what is additive manufacturing?



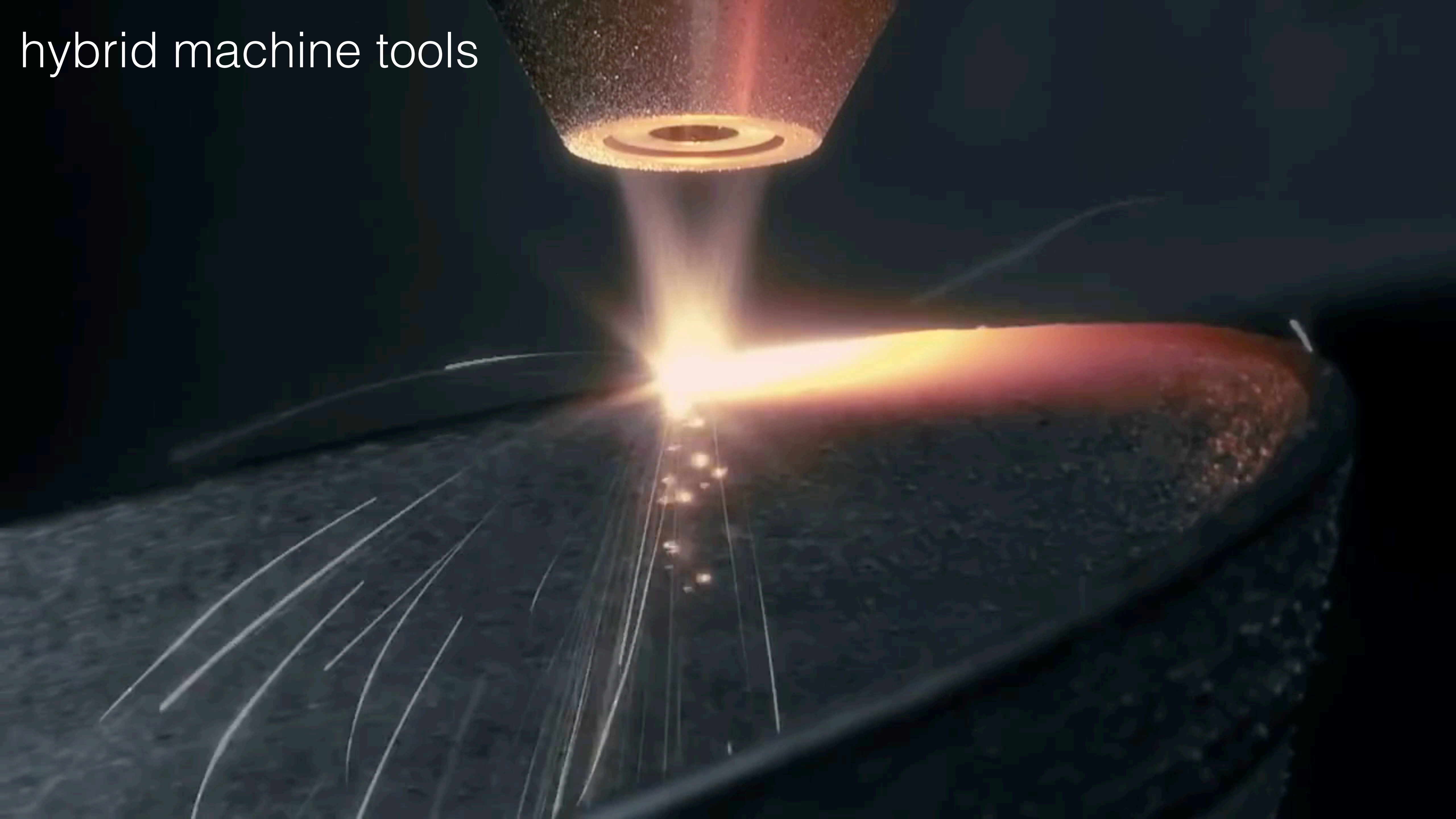
additive vs. subtractive manufacturing



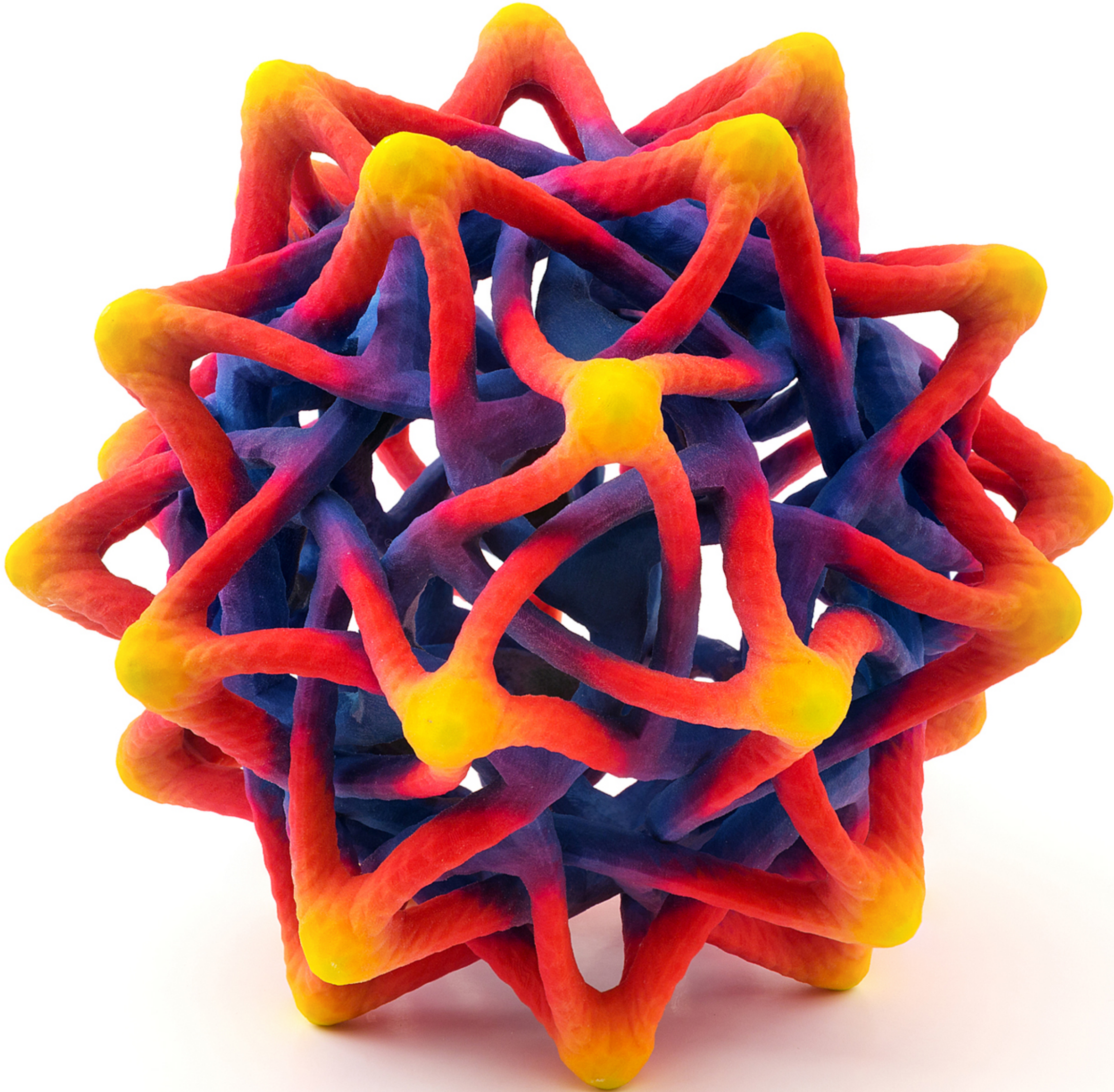
# hybrid machine tools



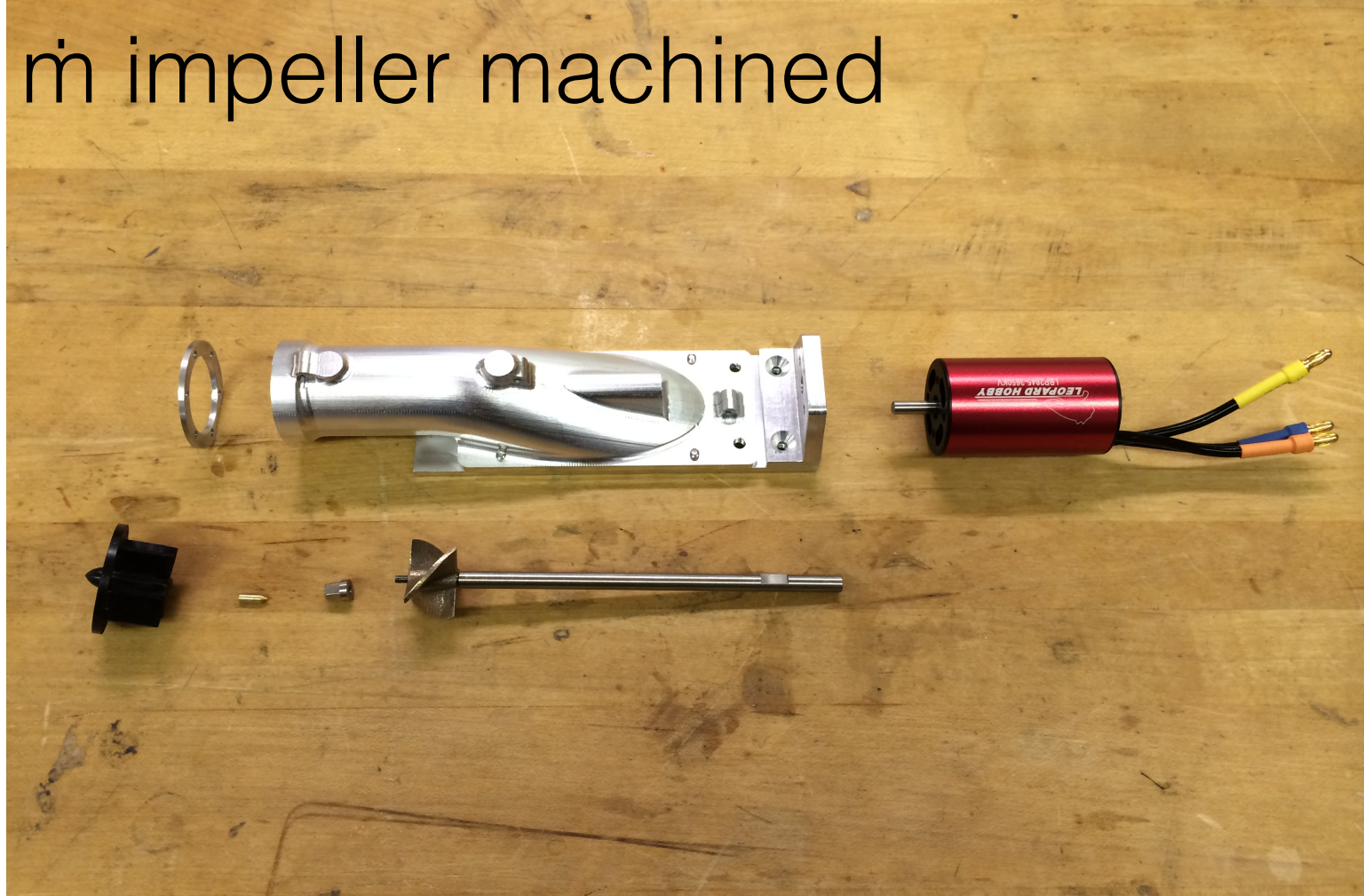
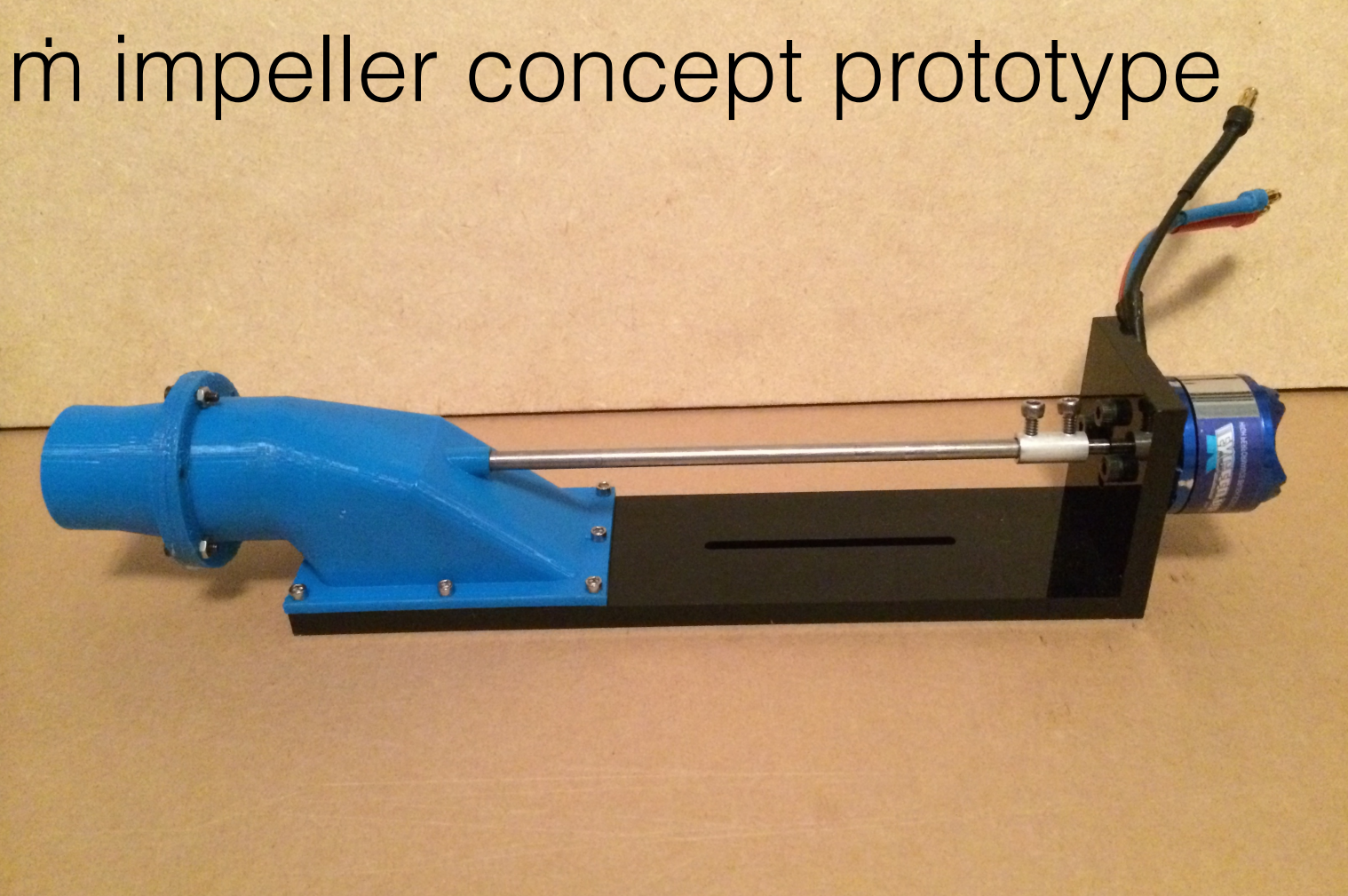
hybrid machine tools



# additive manufacturing vs. “3D printing”

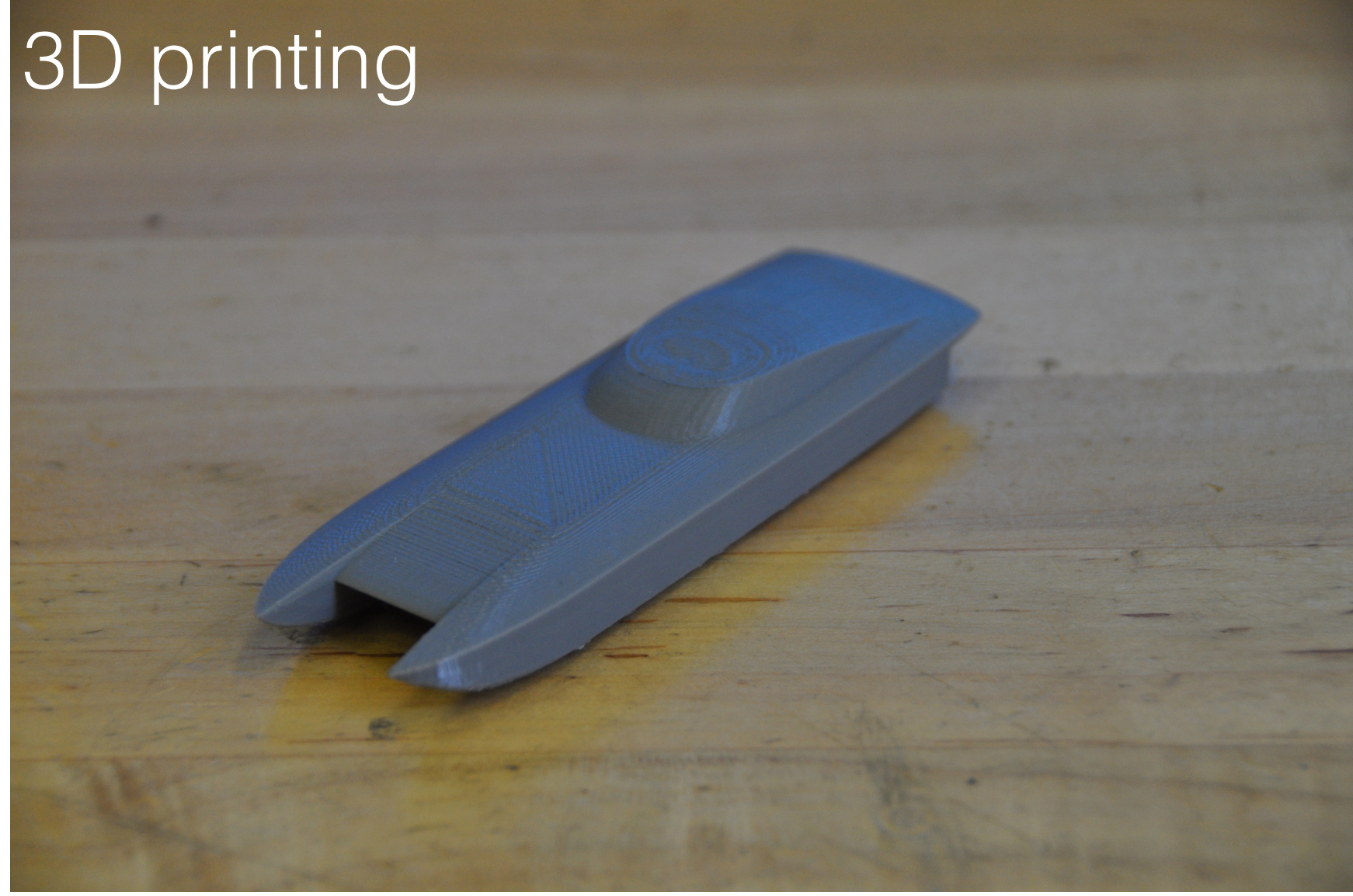


# uses of additive manufacturing

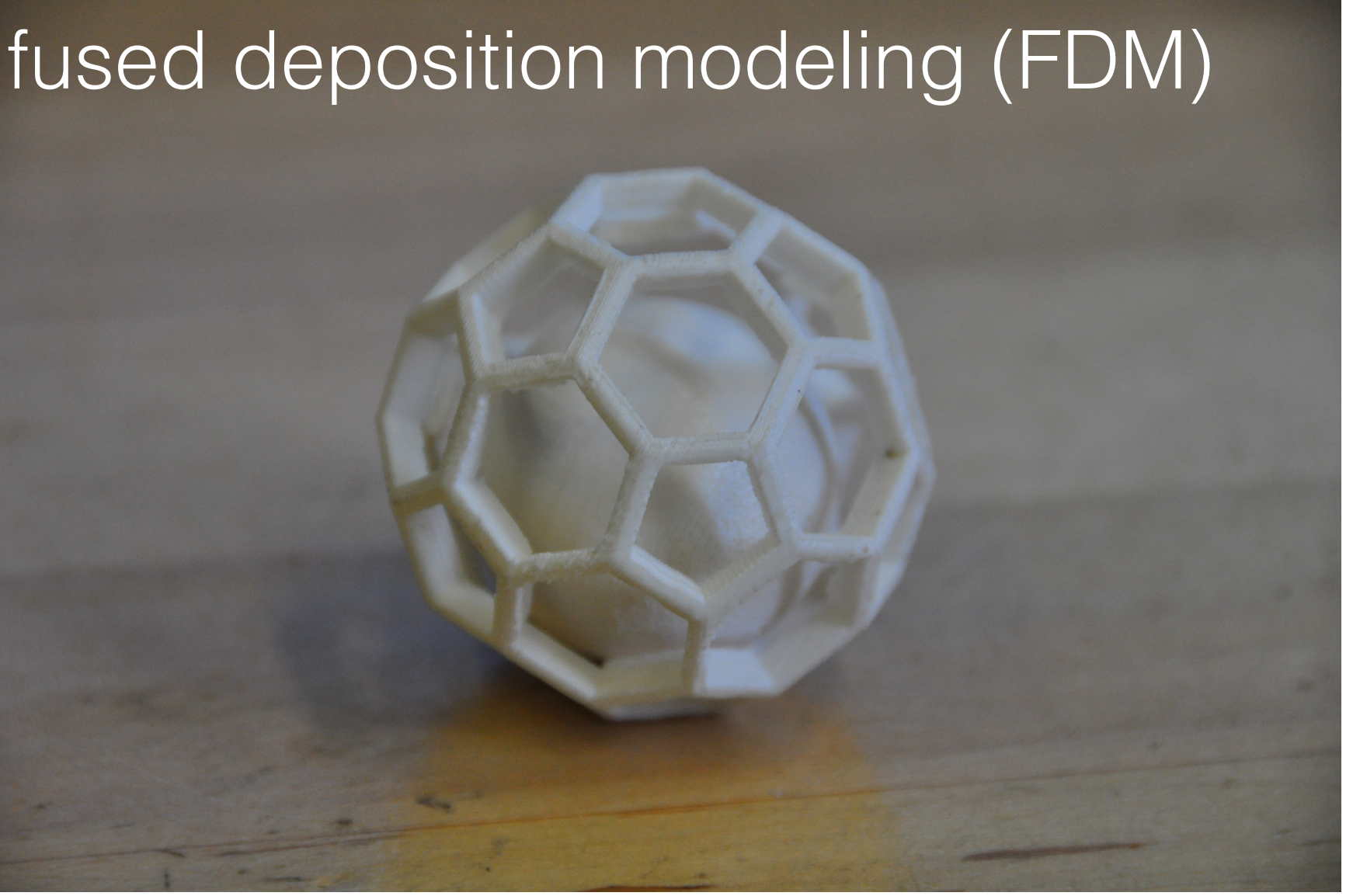


# types of additive manufacturing

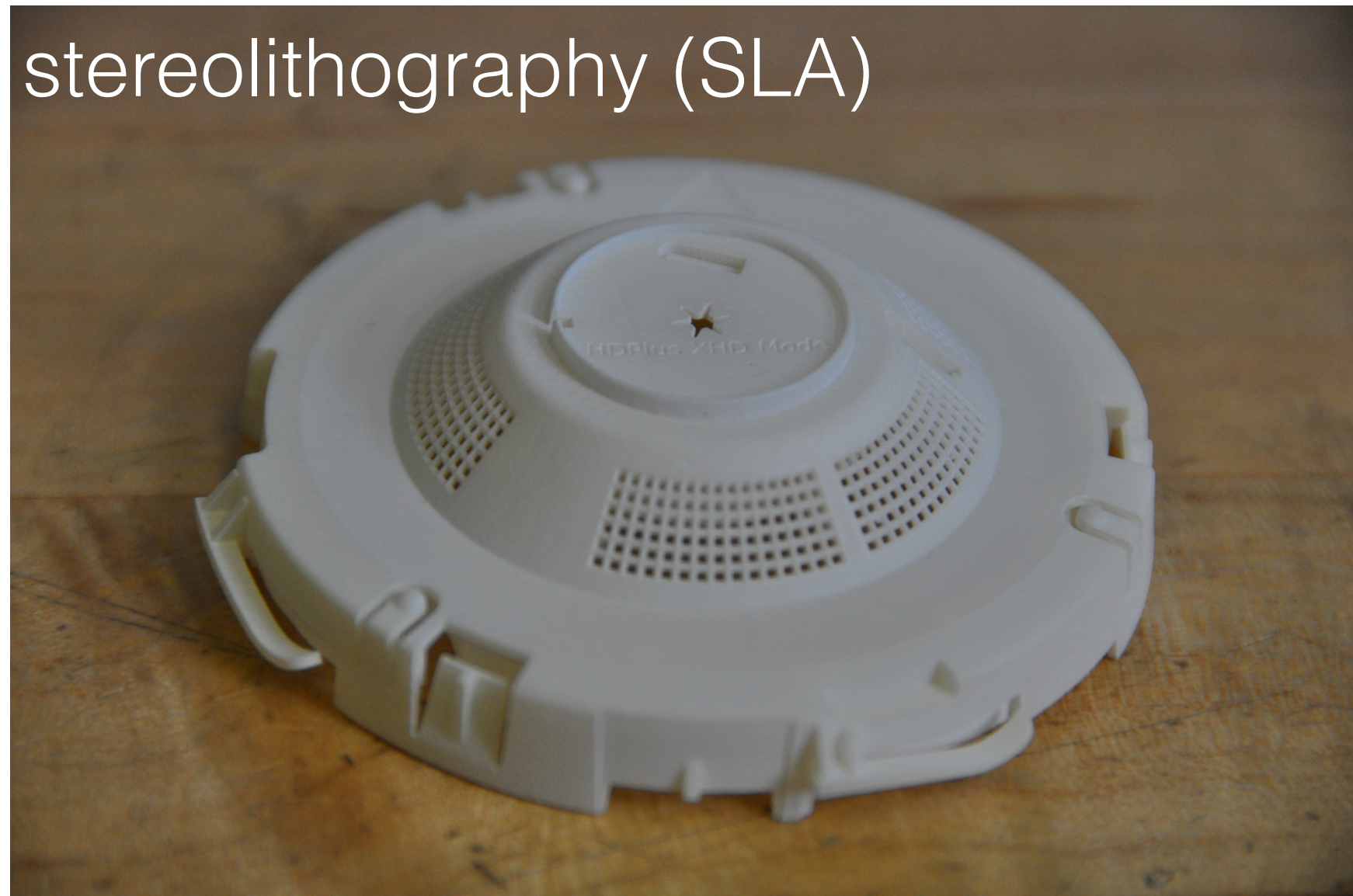
3D printing



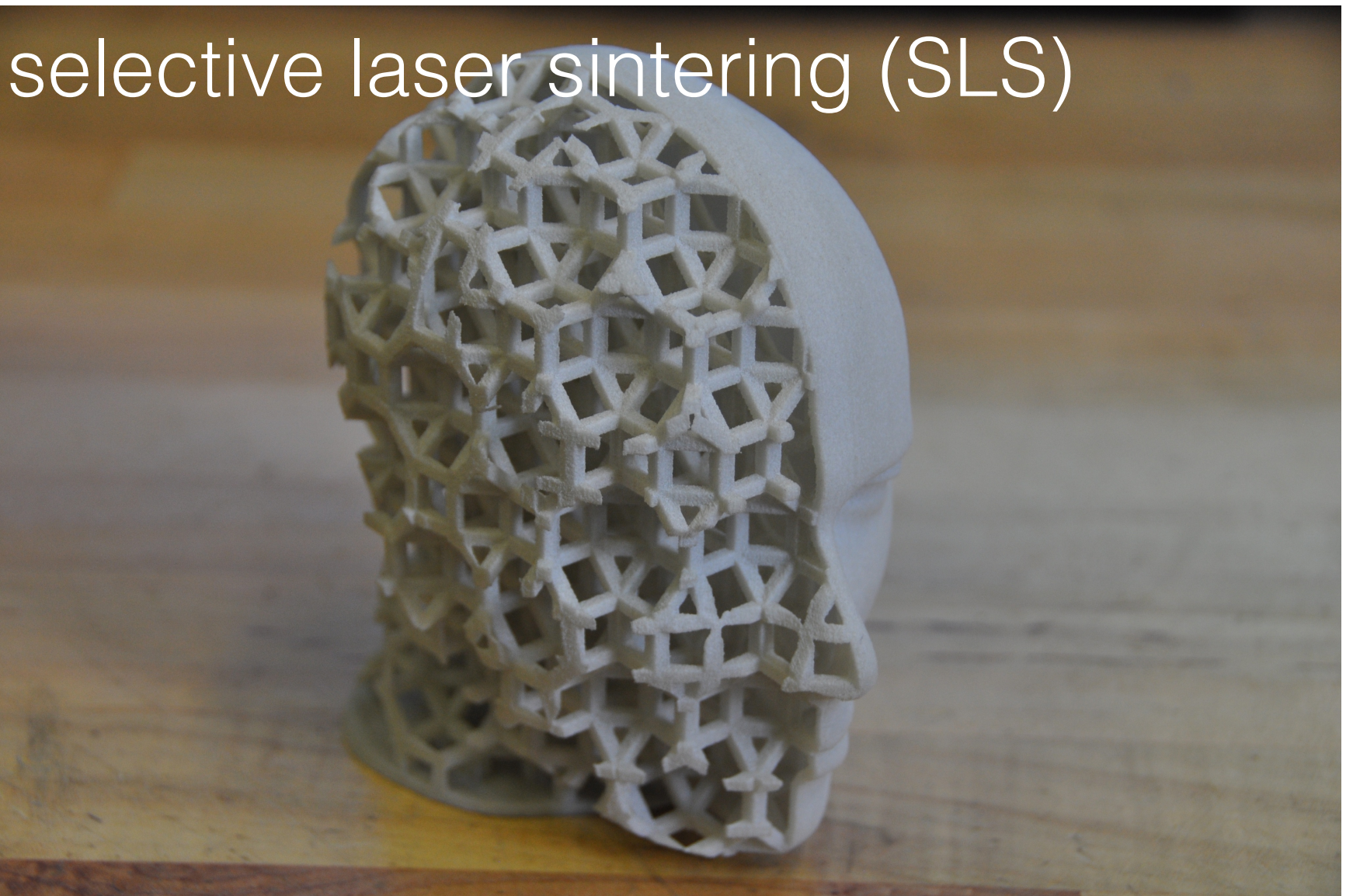
fused deposition modeling (FDM)



stereolithography (SLA)



selective laser sintering (SLS)

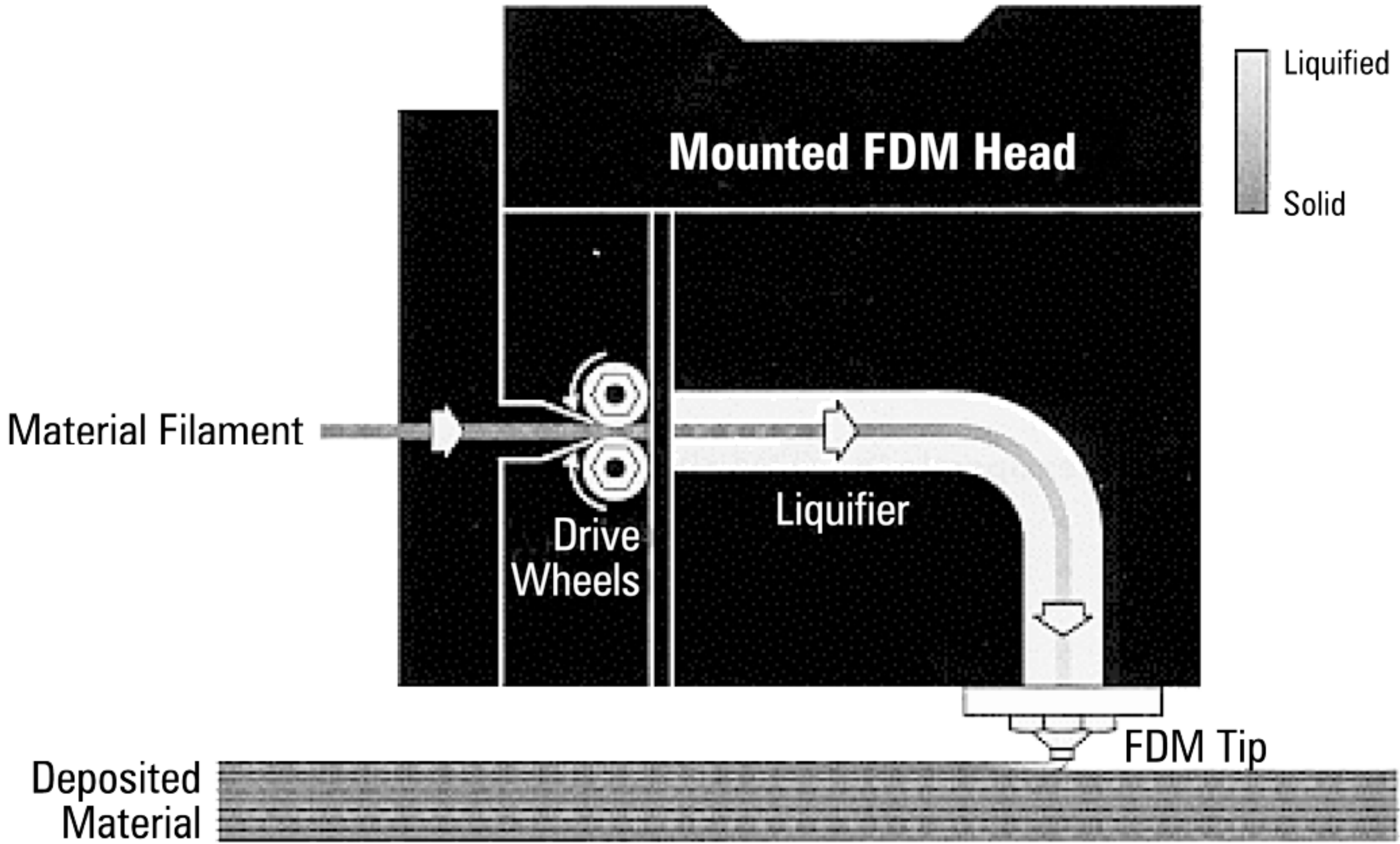


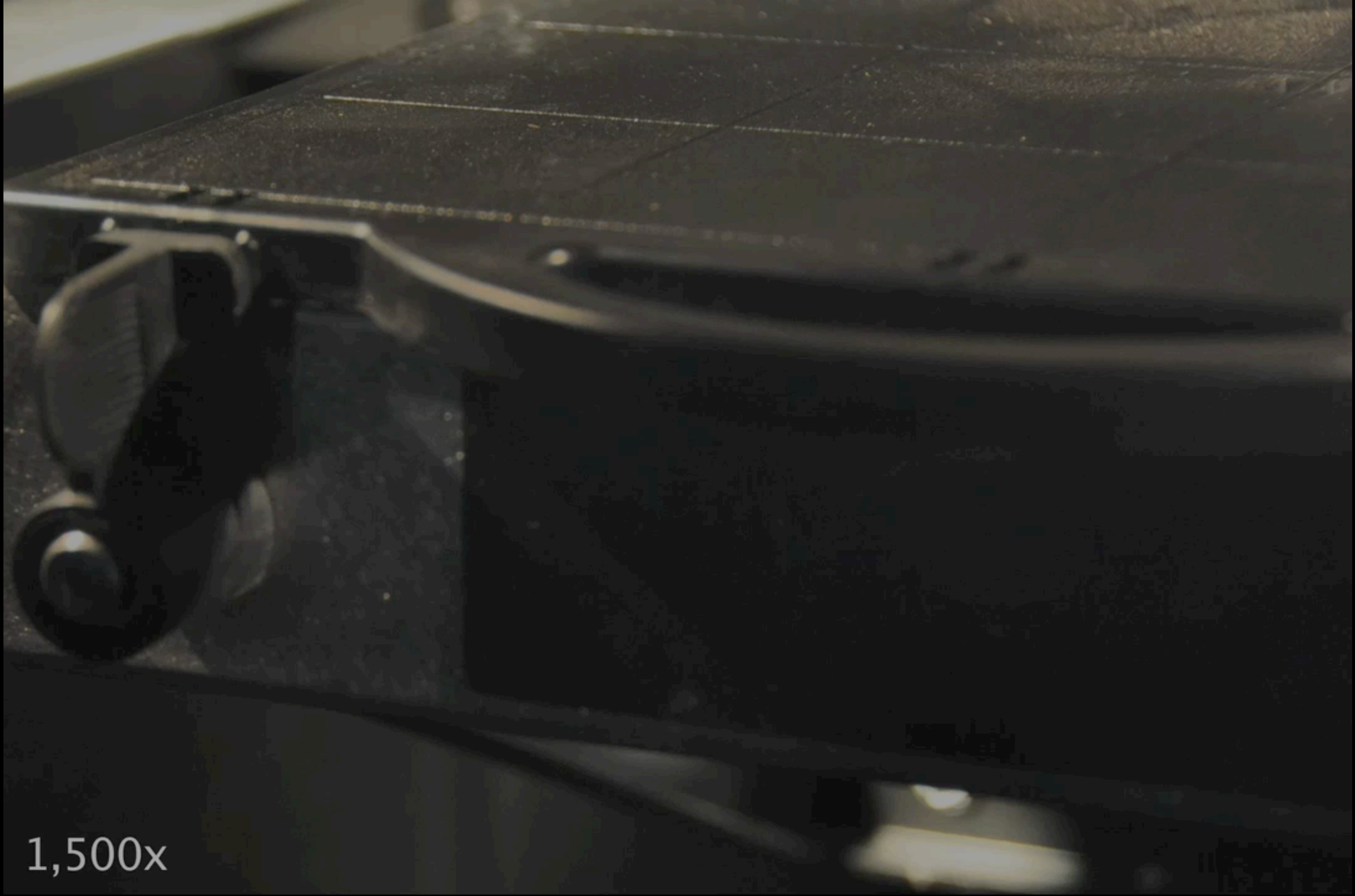


3D printing



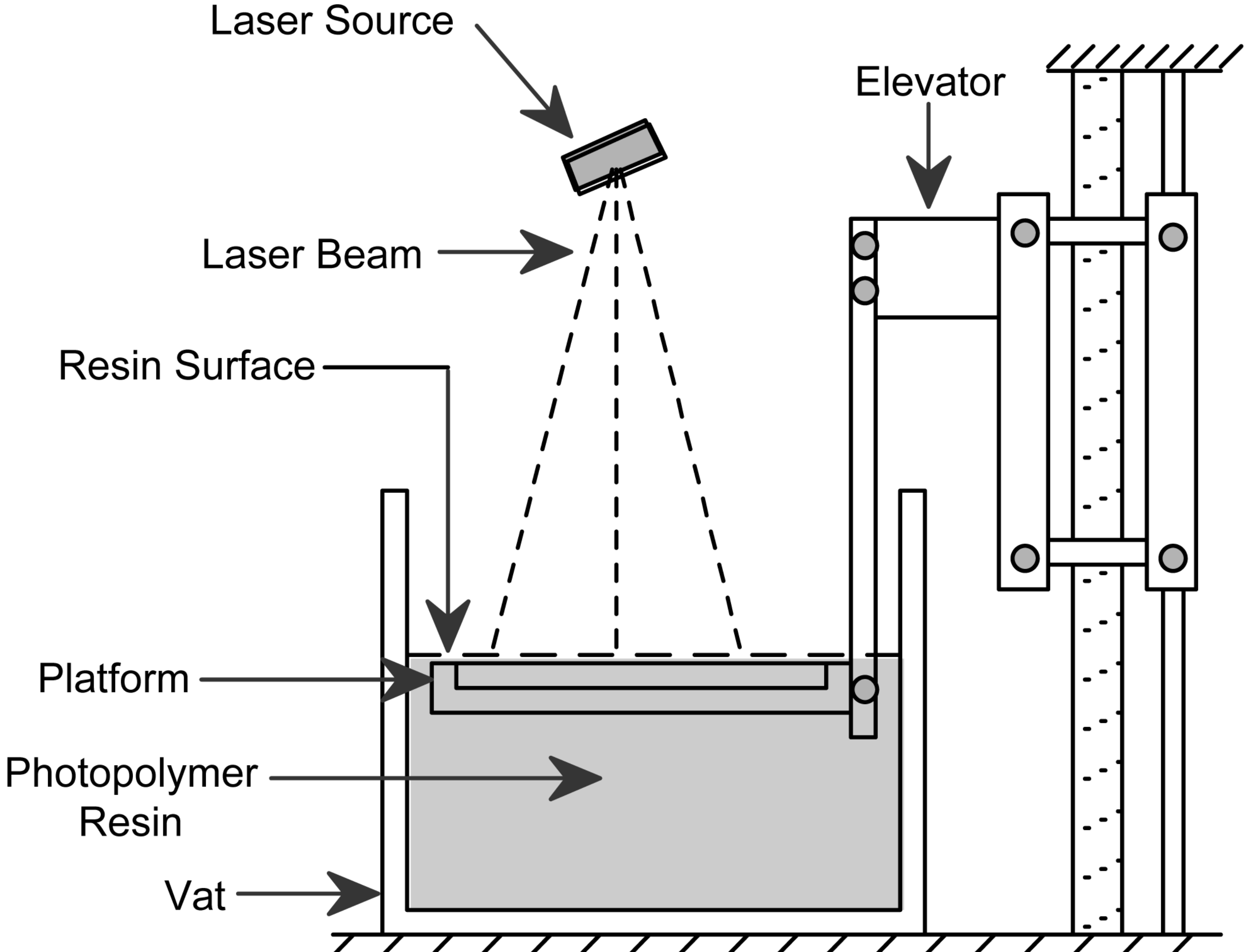
# fused deposition modeling (FDM)



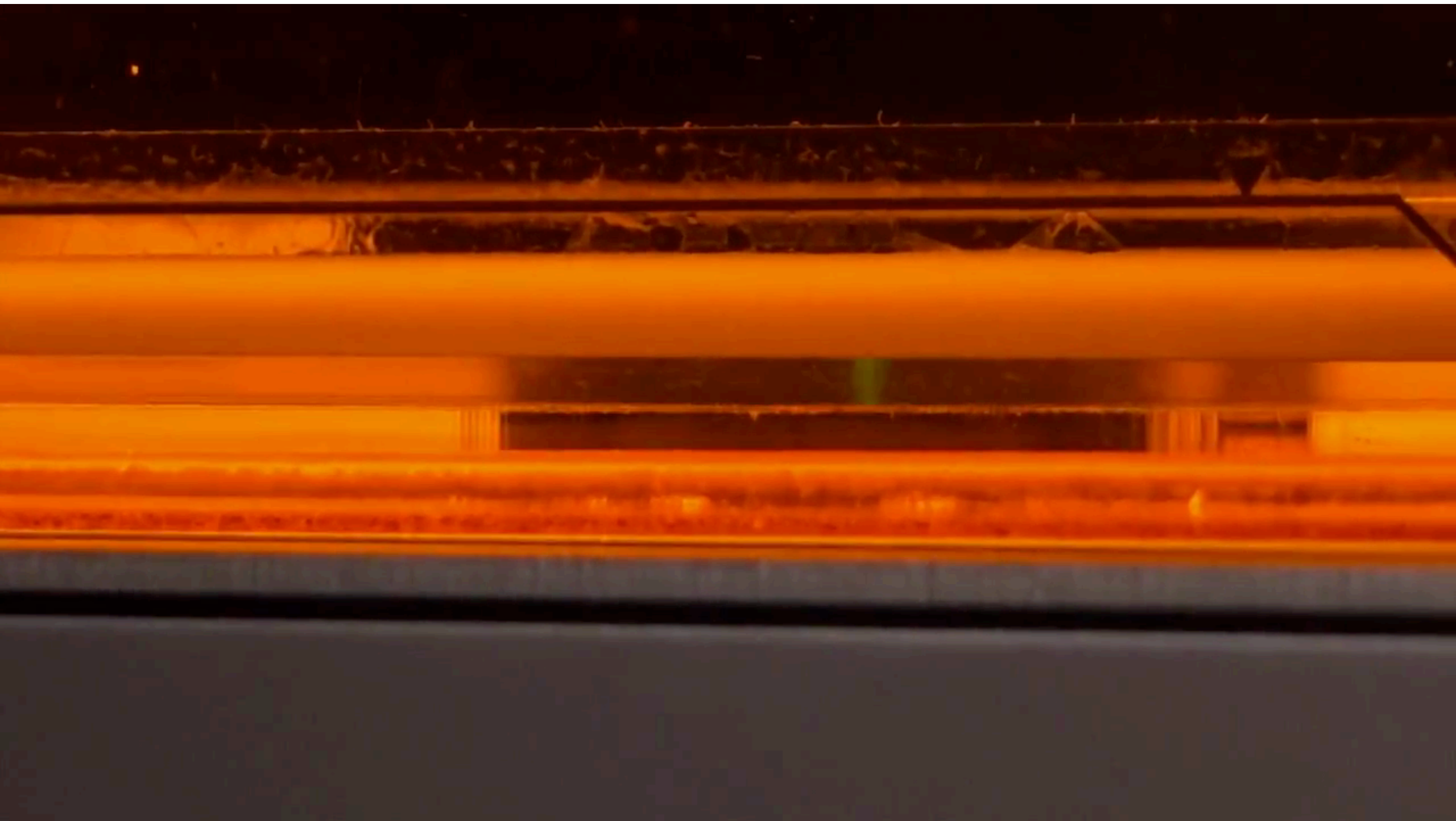


1,500x

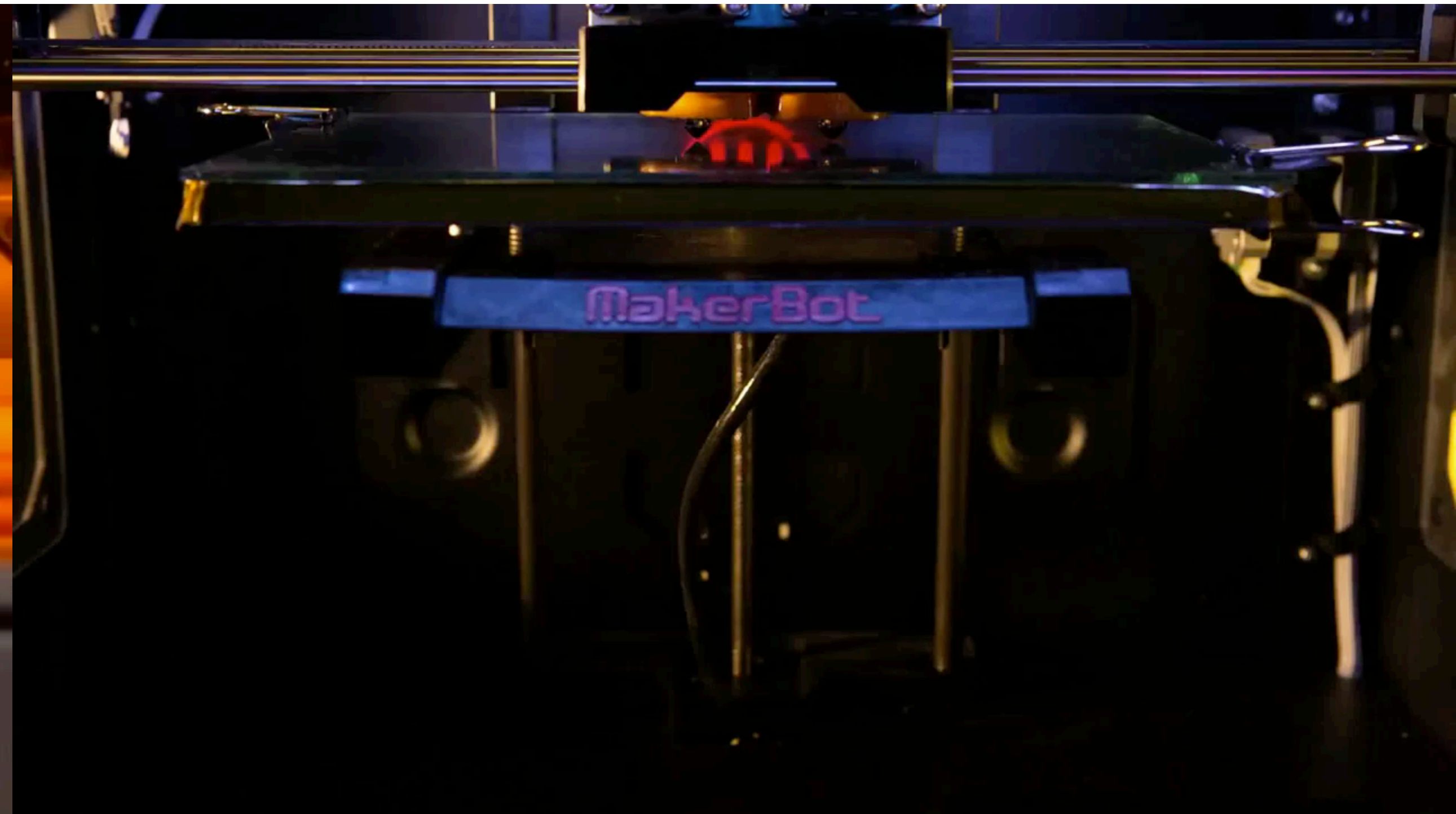
# stereolithography (SLA)



# SLA vs. FDM

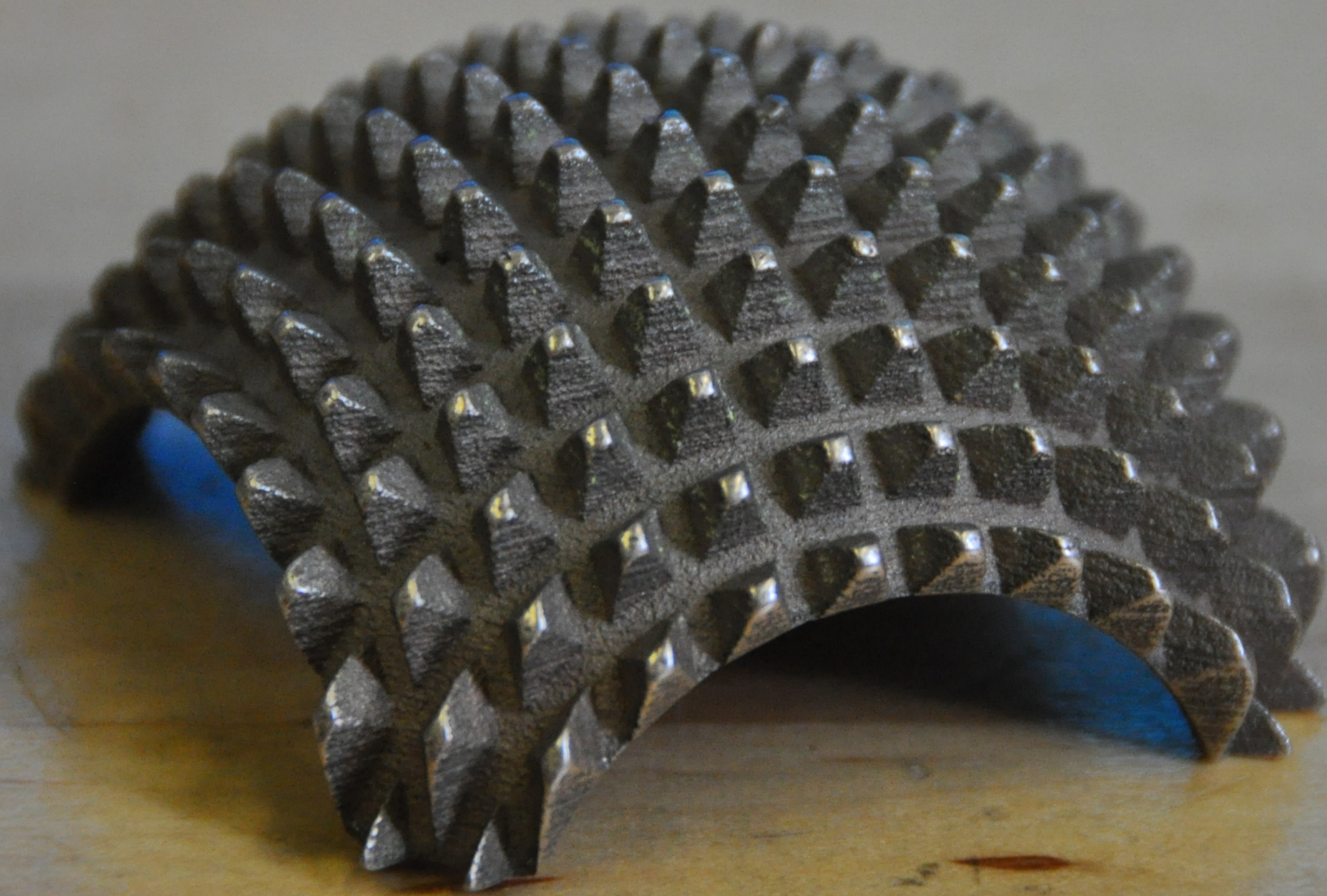


Form1 (SLA)



MakerBot Replicator 2 (FDM)

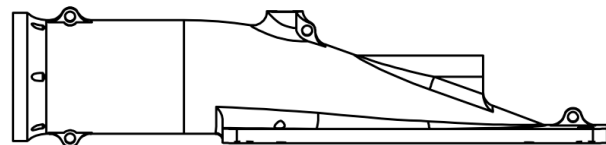
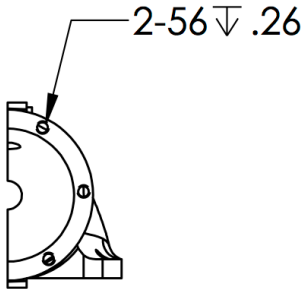
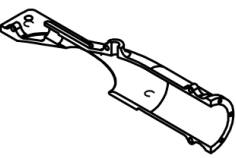
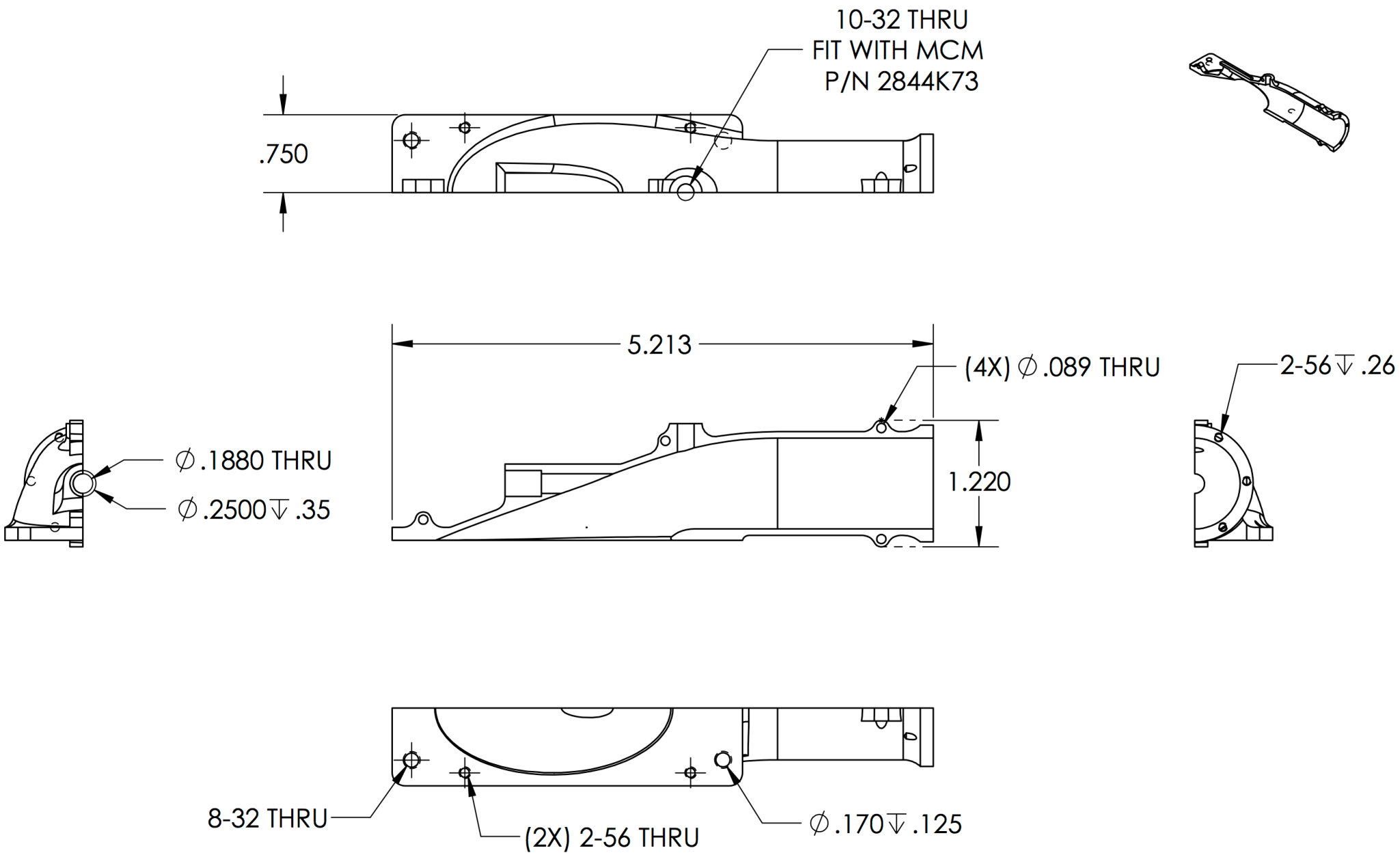
selective laser sintering (SLS)



selective laser sintering (SLS)



# design for manufacturing (DFM)

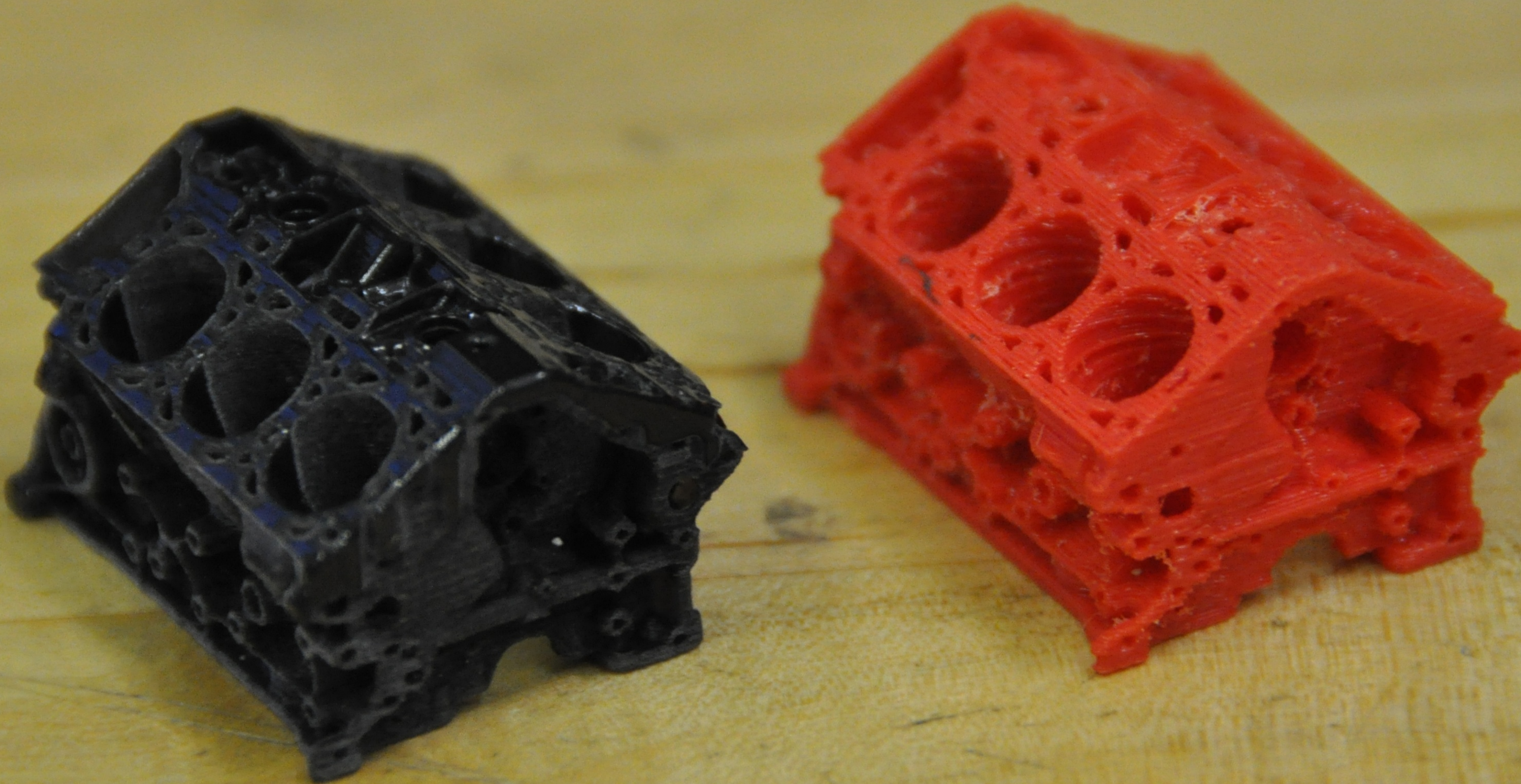


UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL $\pm 1/64$ ANGULAR: MACH $\pm 1$ TWO PLACE DECIMAL $\pm .01$ THREE PLACE DECIMAL $\pm .005$ FOUR PLACE DECIMAL $\pm .0005$	MATERIAL	NAME	DATE	TITLE:	
	6061 Aluminum	DRAWN	AML	04.15.13	Imp. Duct R
	FINISH	CHECKED	ENG APPR.	SIZE	DWG. NO.
	DO NOT SCALE DRAWING	Q.A.	MFG APPR.	A	REV 1
				SCALE: 1:8	WEIGHT:
					SHEET 1 OF 1



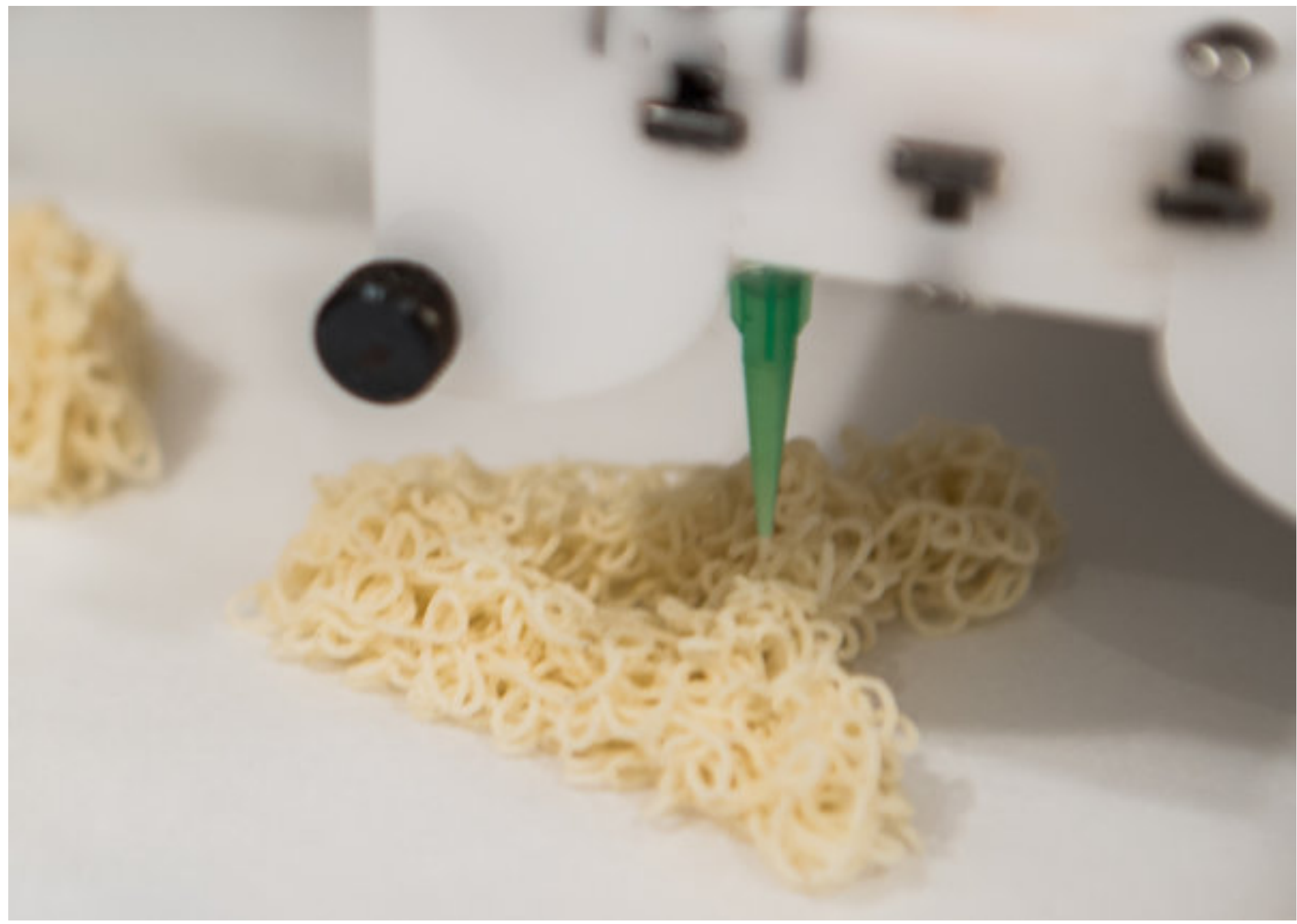
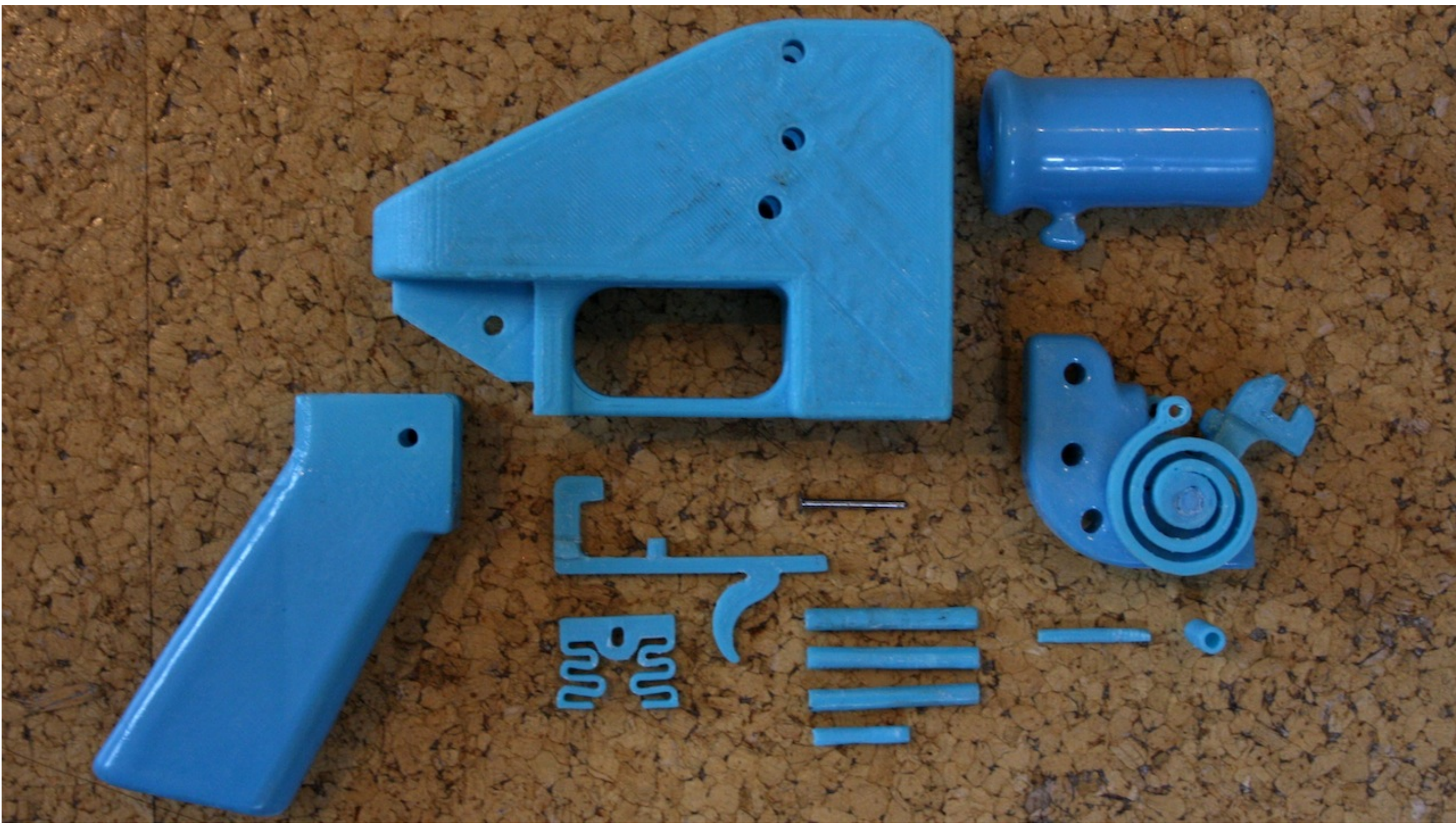


design for printing vs. printing designs

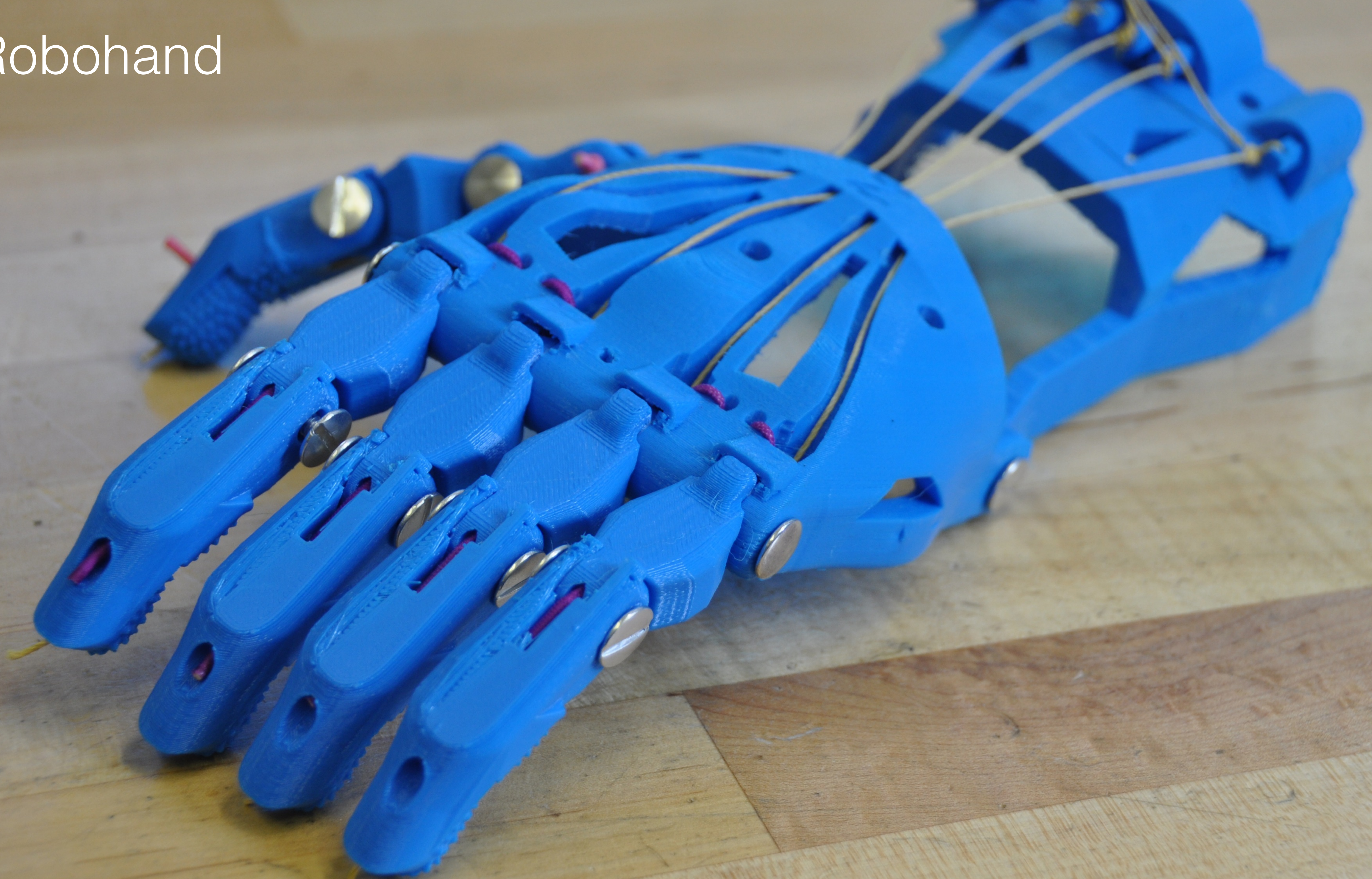


in the news...

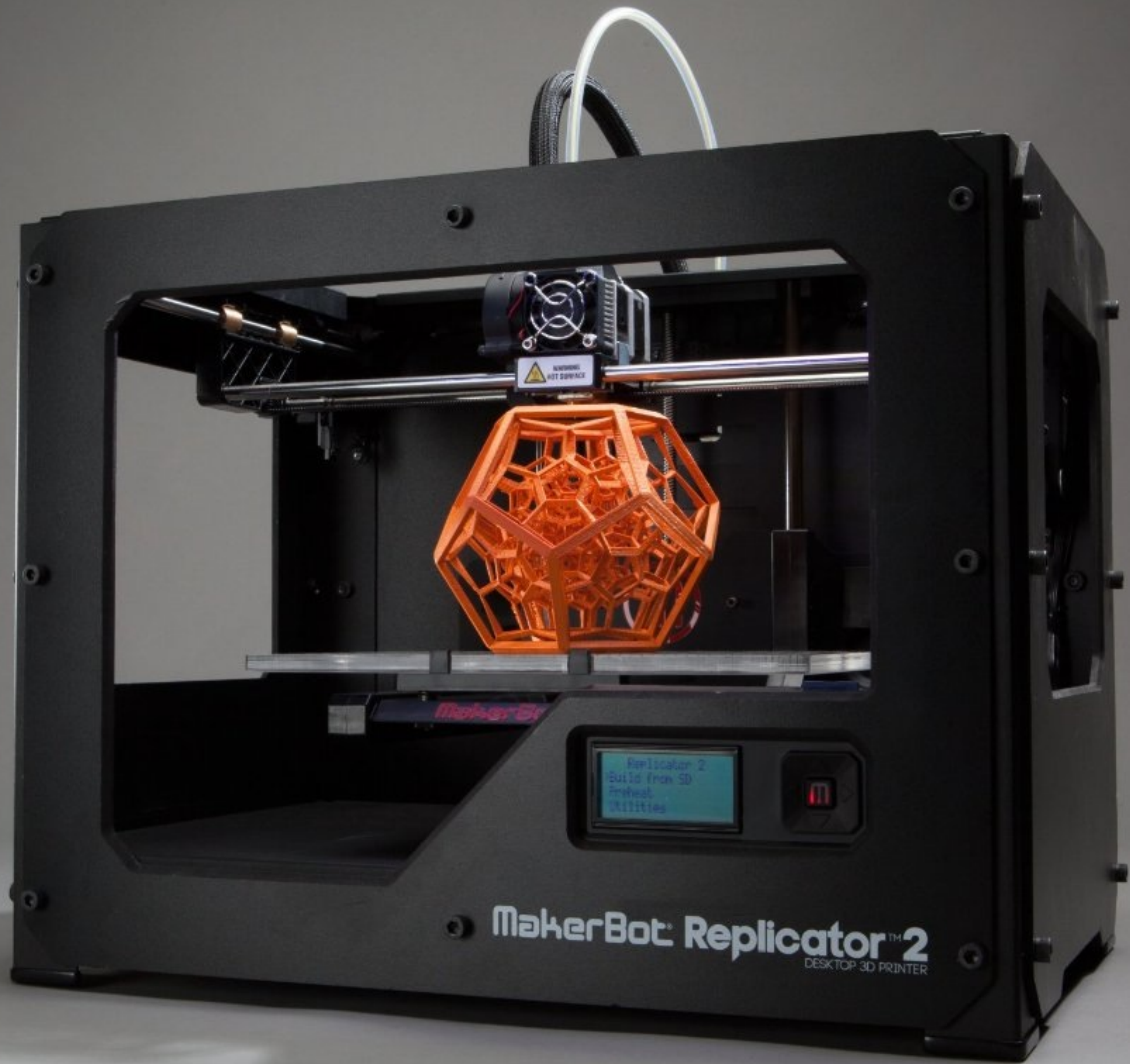
# TITAN ARM



Robohand



MakerBot



MakerBot Replicator™ 2  
DESKTOP 3D PRINTER

# MakerBot extruder

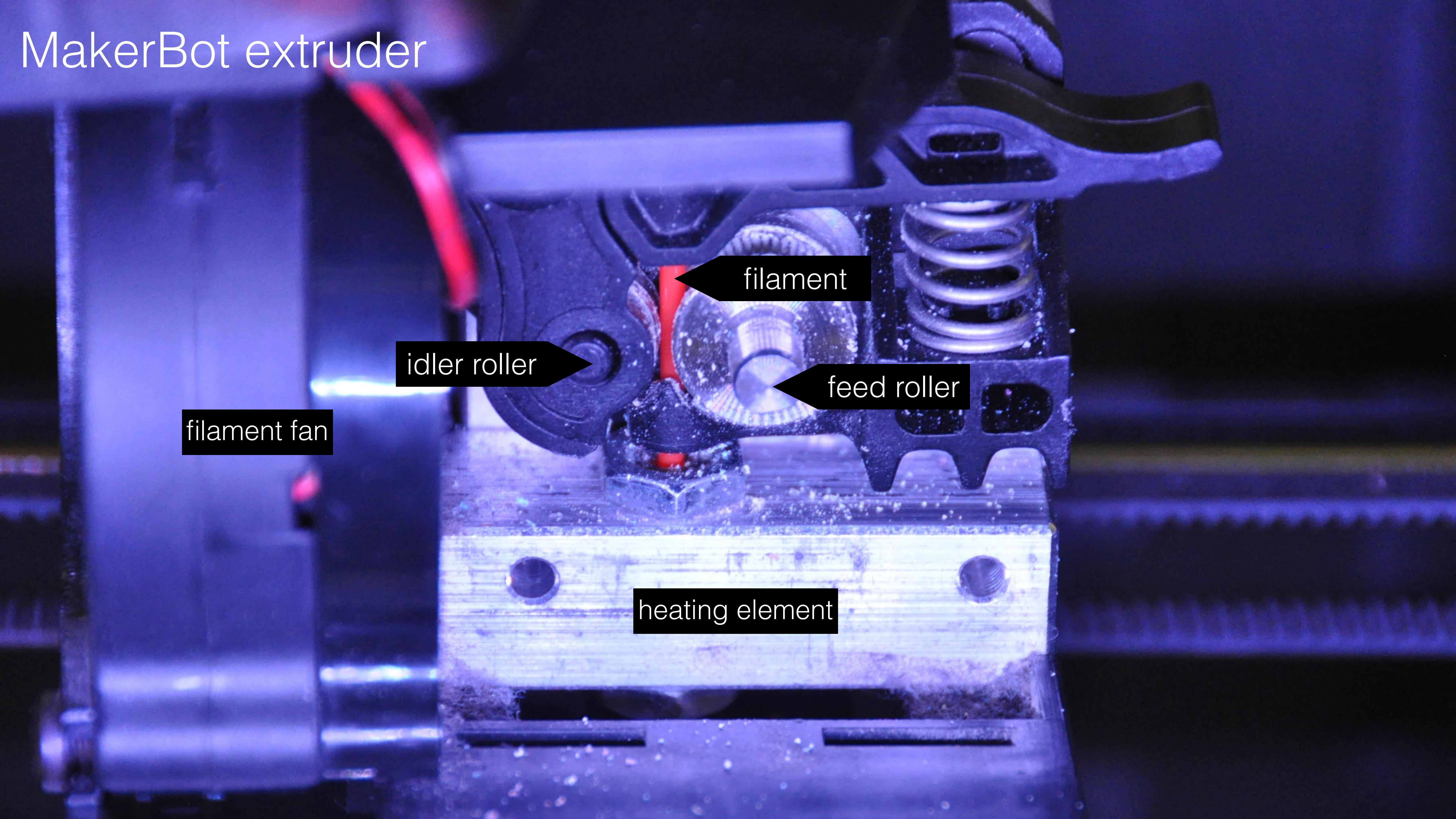
idler roller

filament

feed roller

filament fan

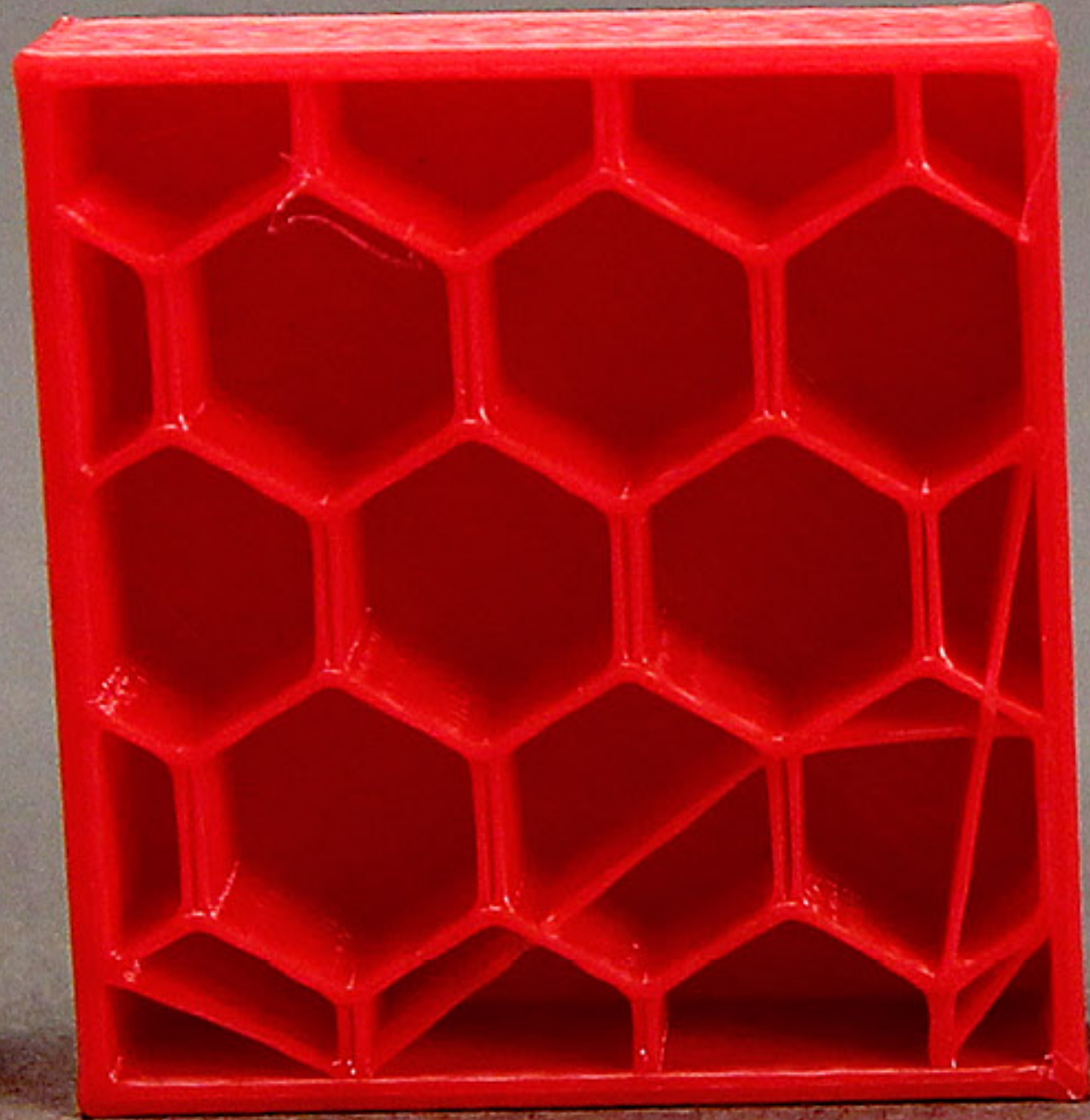
heating element



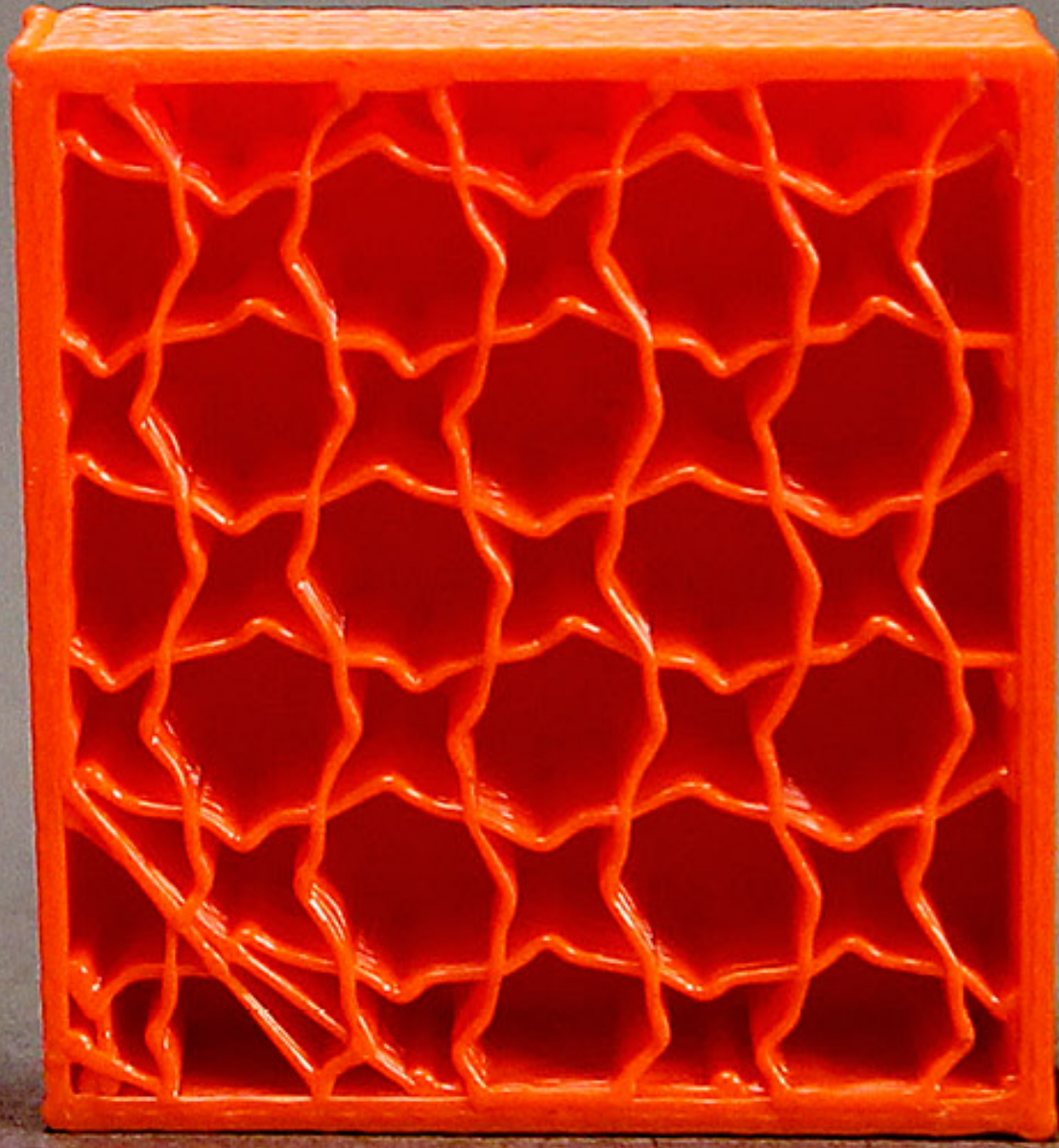
# designing for the MakerBot: infill patterns



▲  
Linear



▲  
Hexagonal



▲  
Morroccanstar

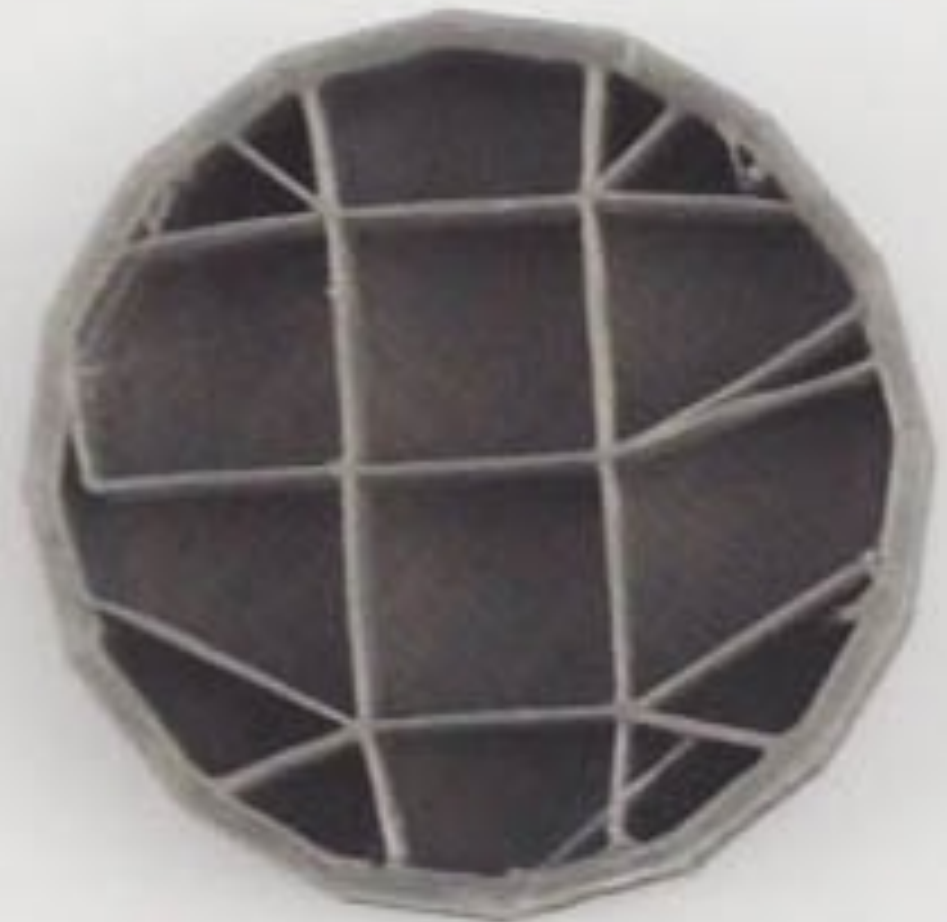


▲  
Catfill

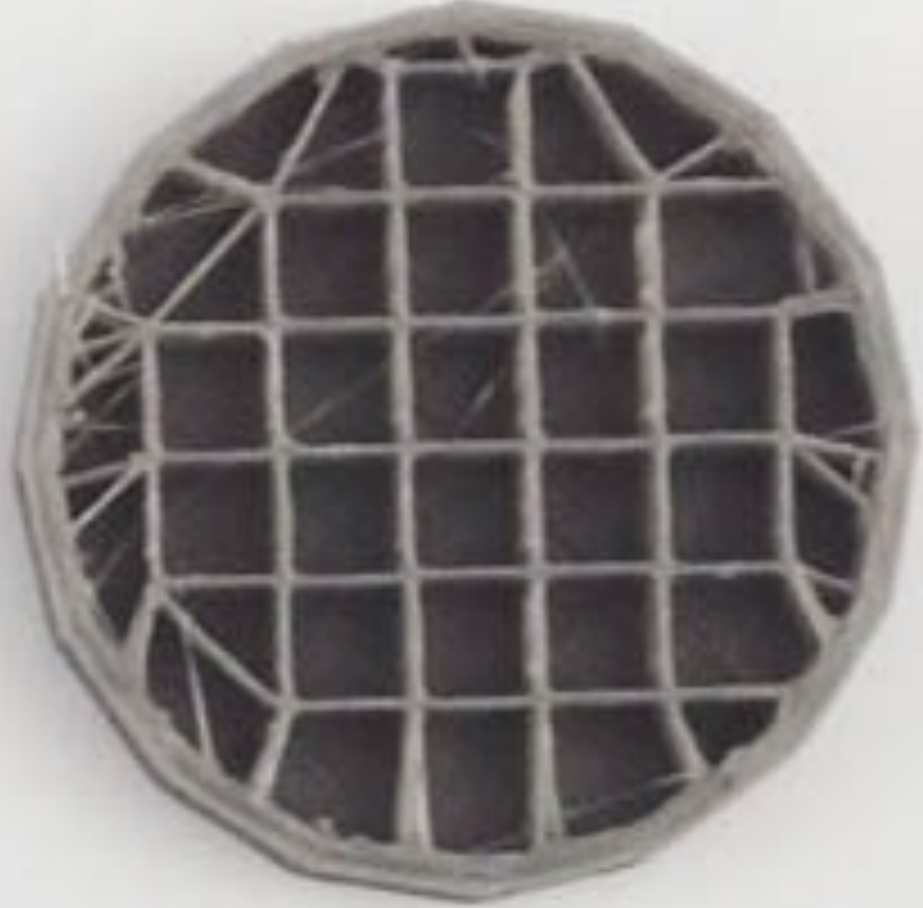
# designing for the MakerBot: infill density



0%



5%



10%



15%



100%



75%



50%



25%

# designing for the MakerBot: support material



upside down  
support



upside down  
support removed



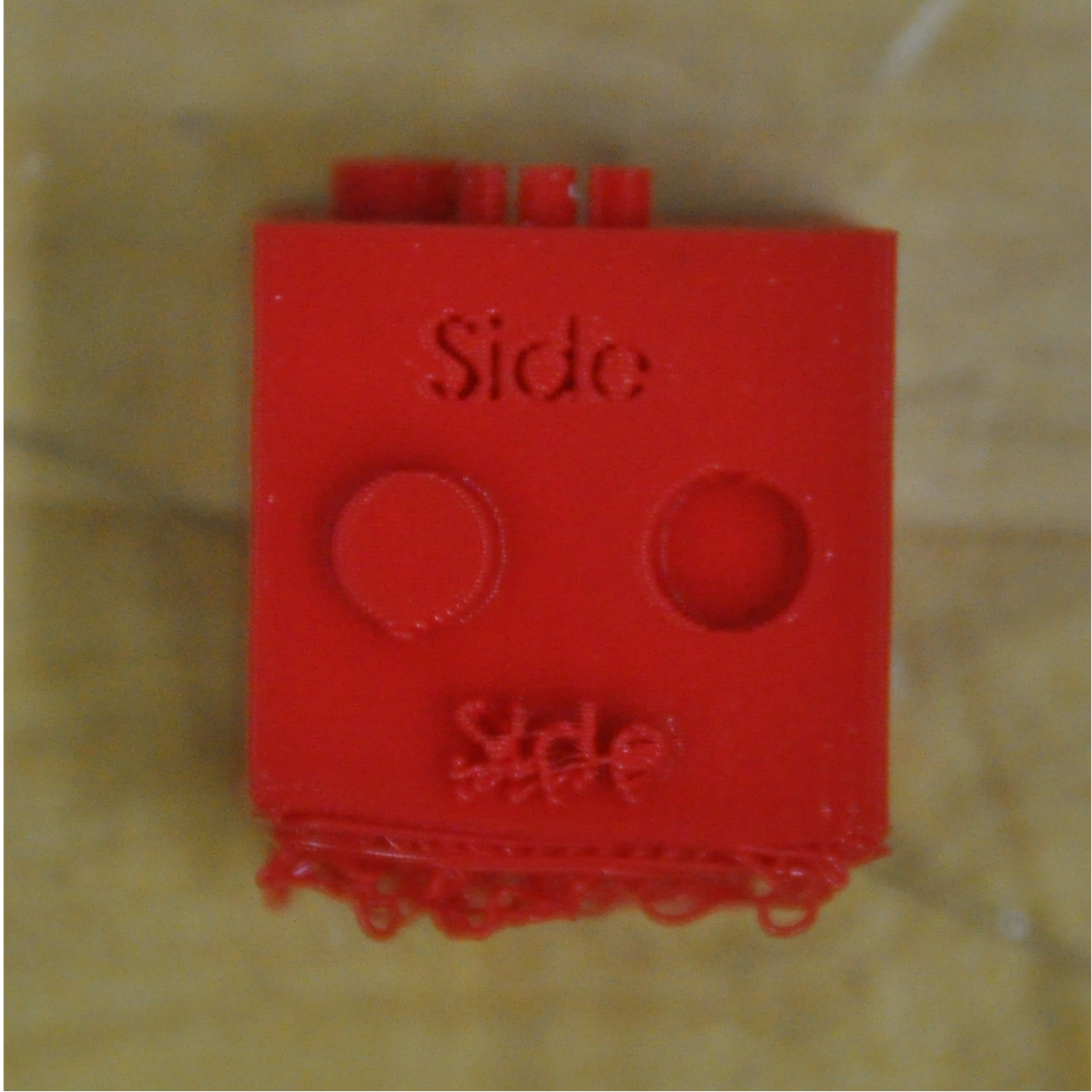
right side up  
no support



# designing for the MakerBot: feature orientation



top features

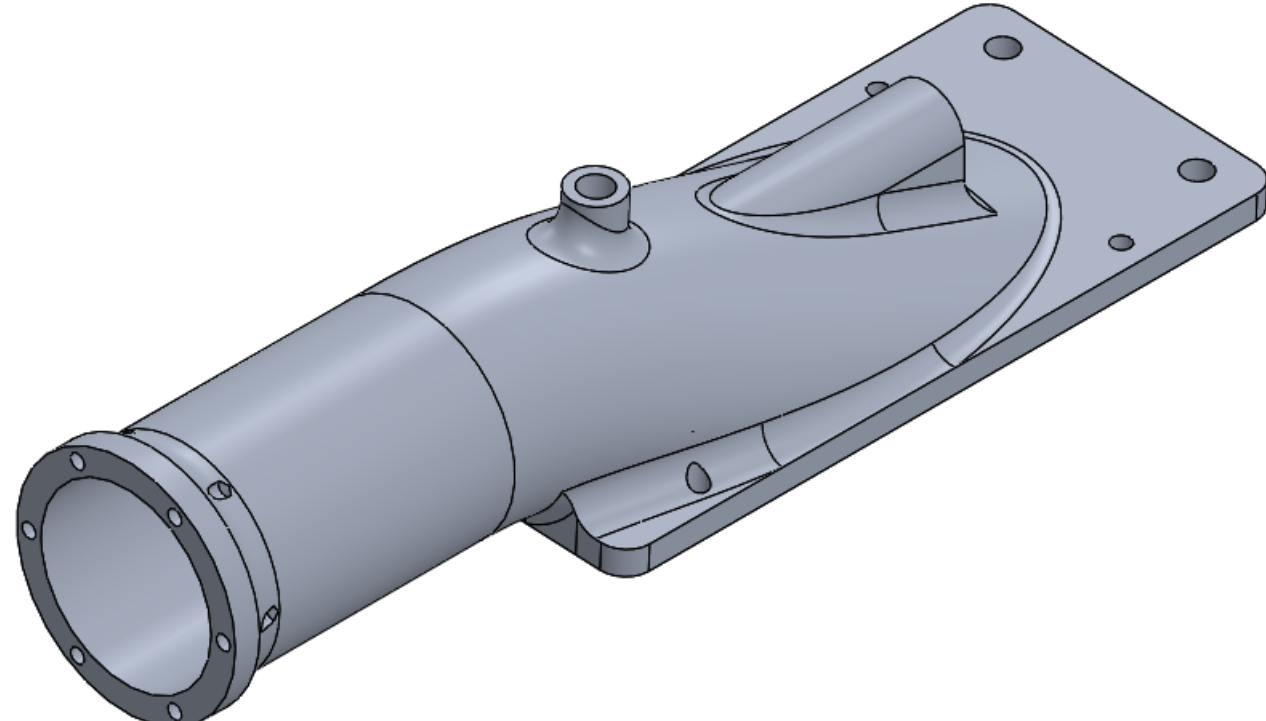


side features

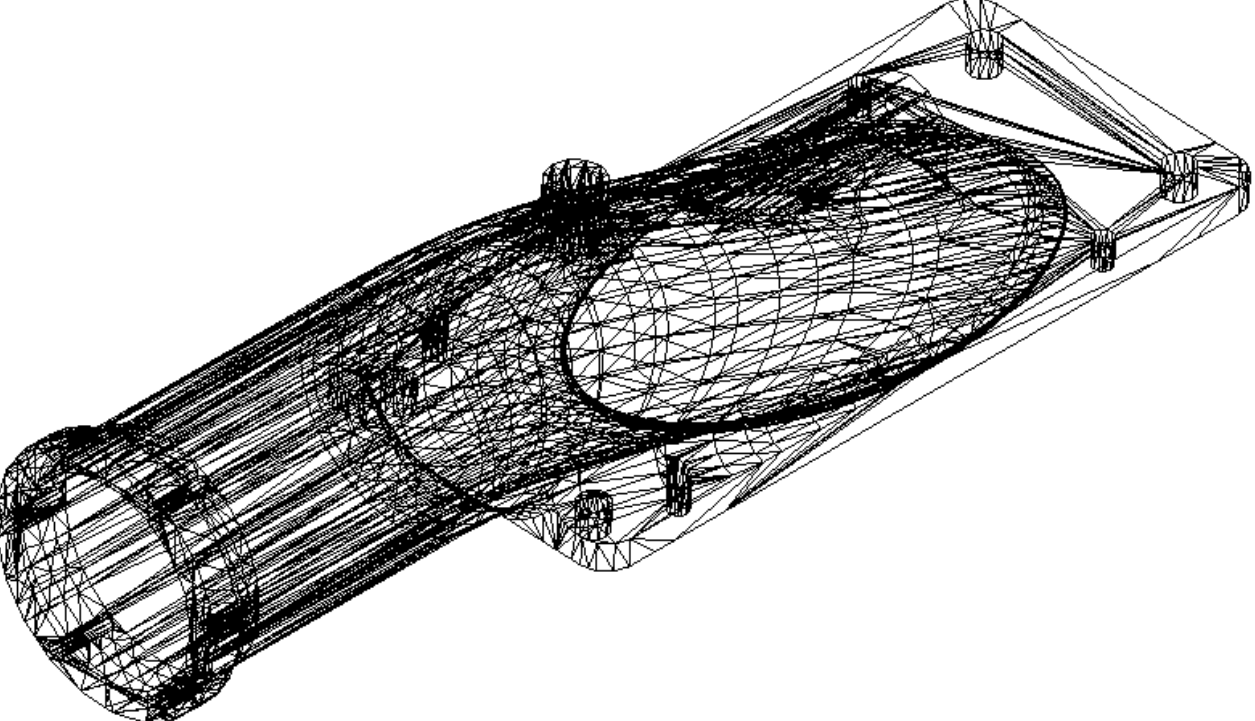


bottom features

# exporting for the MakerBot



.SLDPRT

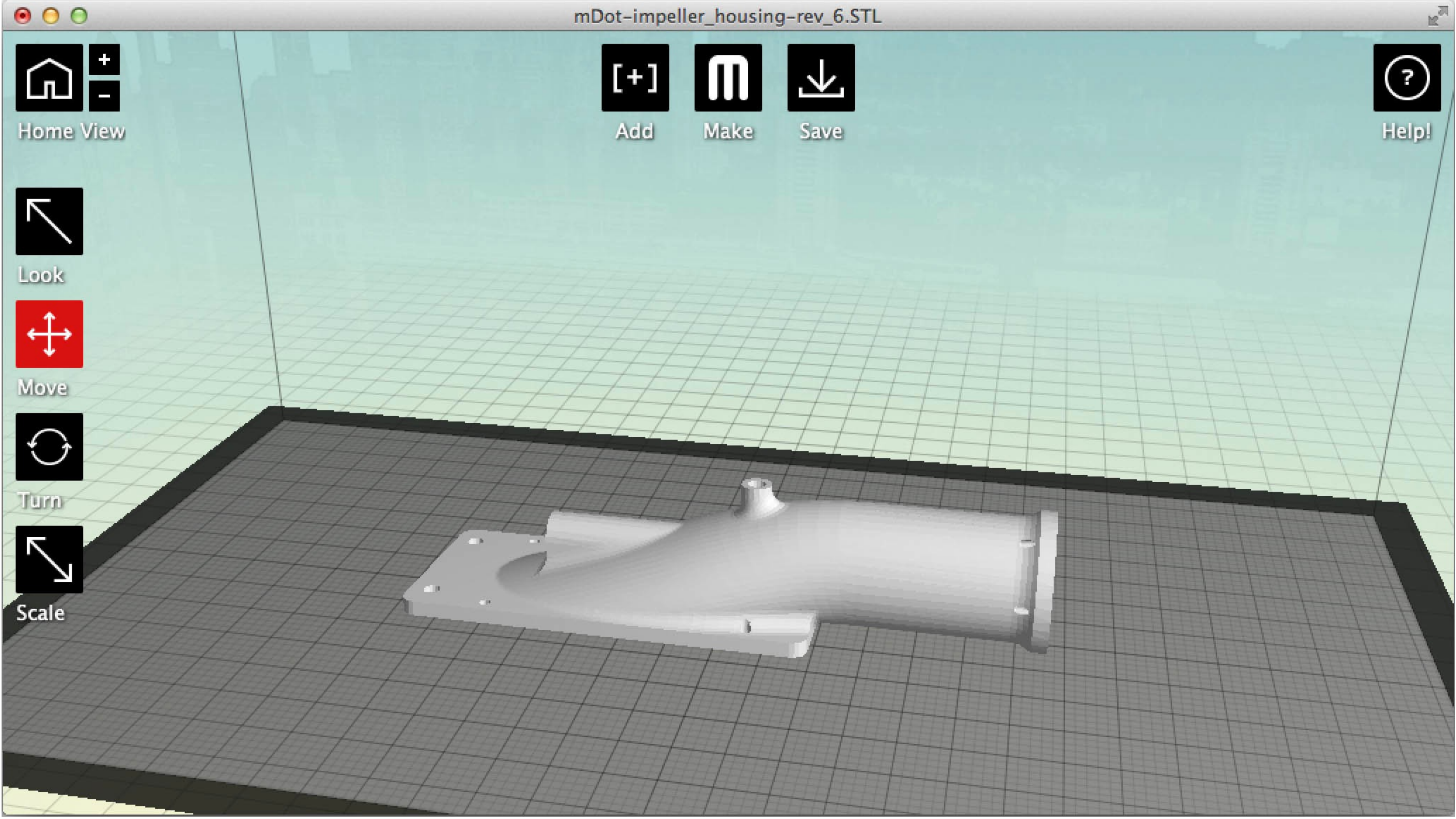


.x3g

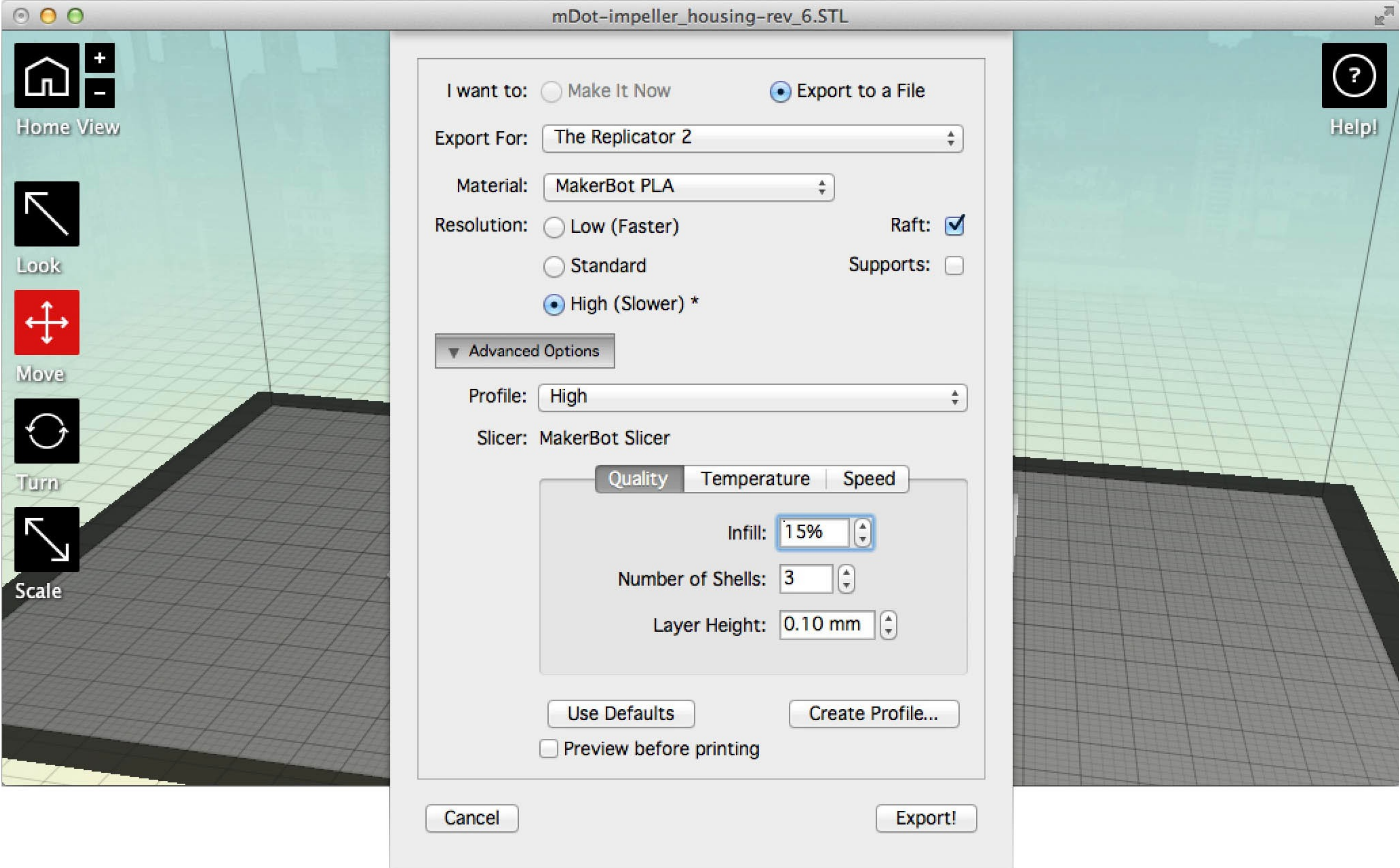


PLA

# MakerWare



# MakerWare



A5: MatchBox Derby

