Supplementary Information

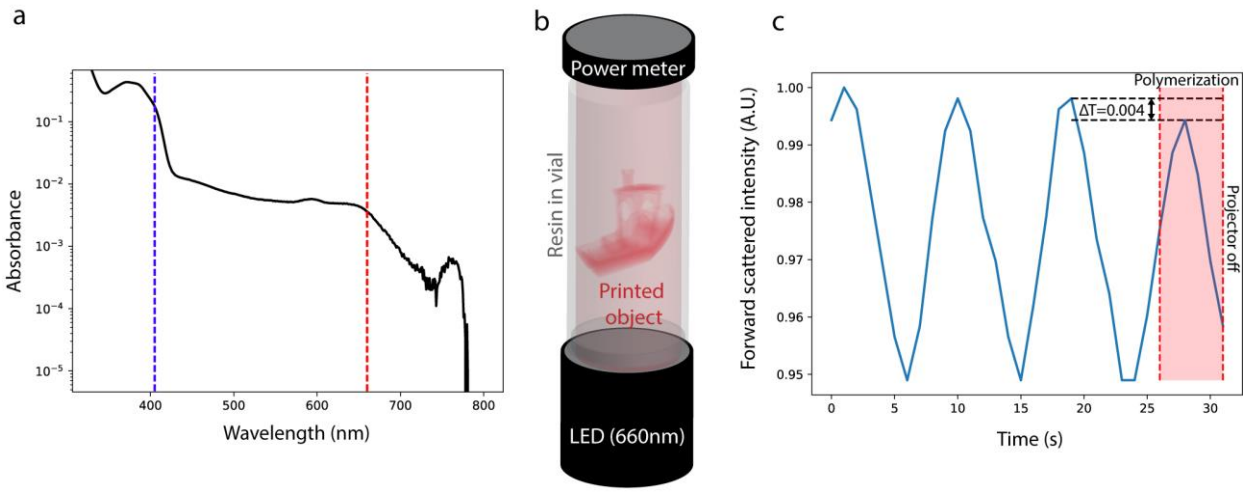

Fig. S1. a) Optical absorbance spectrum of the photoinitiator (TPO-L) at the concentration used in this paper (1.75mM), for a 10mm path length cuvette. The vertical purple dashed line indicates the projector wavelength (405nm); the vertical red dashed line indicates the wavelength of the red LED used for illumination (660nm). The absorbance at 405nm and 660nm are 0.177 and 0.0036, respectively. Given the measured absorbance of 0.0036 for a 10mm path length cuvette, the penetration depth of 660nm light in the resin is $D_p = \left(2.3 \times \frac{A}{l}\right)^{-1} = \left(2.3 \times \frac{0.0036}{10mm}\right)^{-1} = 1208mm$.[2] The expected attenuation due to absorption of the photoinitiator over the height of the vial (95mm) is therefore $1 - e^{-95mm/1208mm} = 7.5\%$. Over the height of a typical large object (20mm), the attenuation is <2%. This small decay of illumination intensity along the vial axis justifies our approximation that the illumination intensity is uniform within the vial. b) Schematic of the optical configuration used to measure change in transmitted power of the red LED through the vial during printing of a 3DBenchy (see c). c) Forward scattered intensity as measured by the power meter in (b). The small intensity oscillation (~2.5% amplitude) is due to imperfect alignment of the power meter to the rotating vial. From 0-26s, the projector is illuminating the vial, but polymerization has not yet started. The red highlighted region from 26-31s indicates the time window over which polymerization Is occurring while the projector is on. The projector is turned off at 31s. The fractional change in peak transmitted intensity due to the onset of polymerization is $\Delta T = 0.004$.

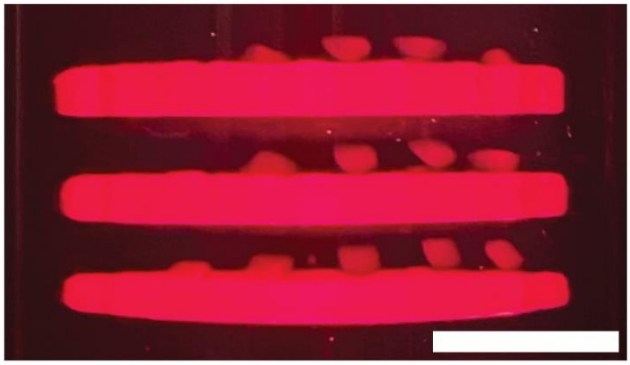

Fig. S2. a) Optical scattering photograph of a calibration disk approximately 2 minutes after exposure is terminated. Gapped disks float above the main disk due to different sedimentation rates of the disconnected bodies. Scale bar is 5mm.

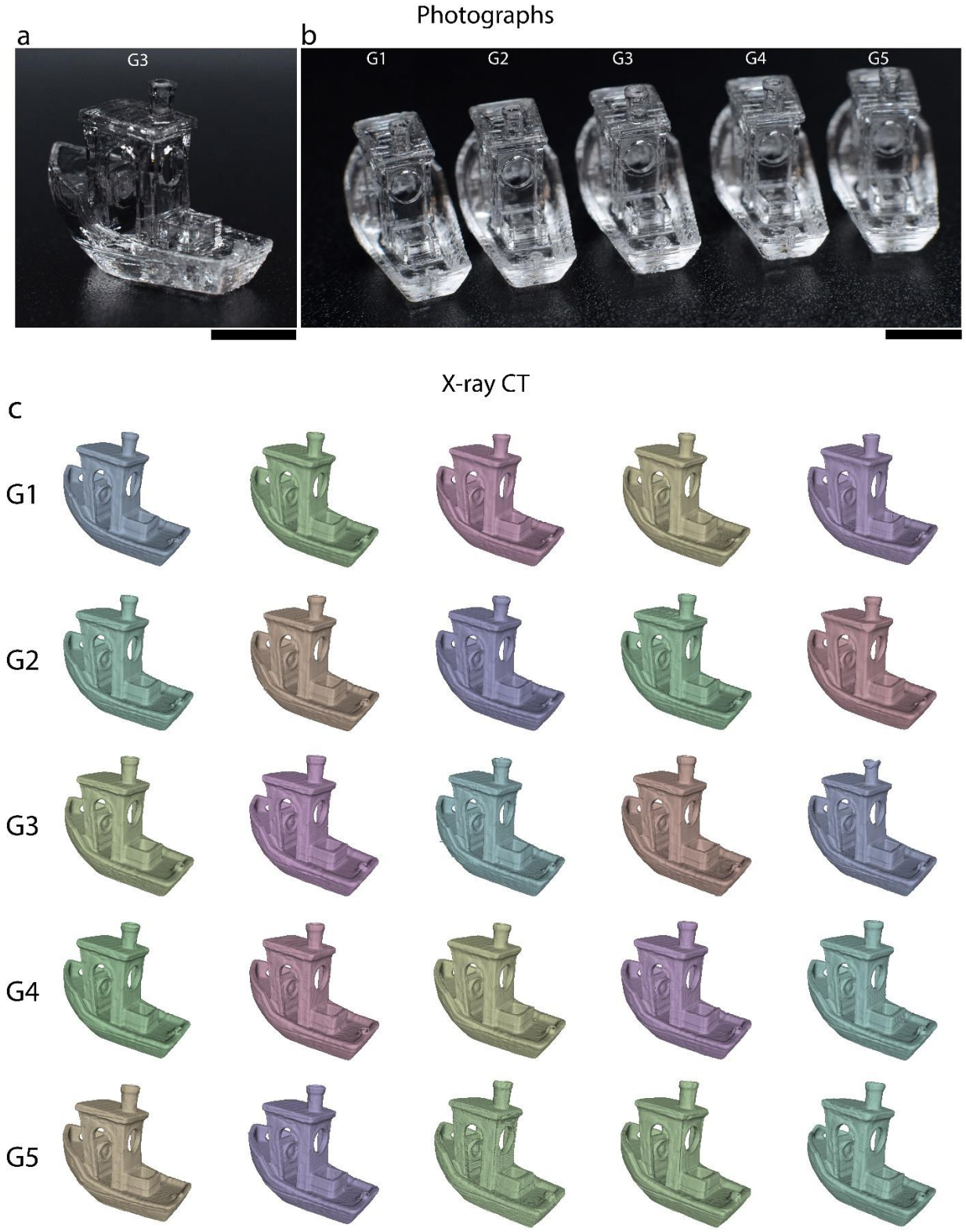

Fig. S3. a) Photographs of a typical AE-VAM printed 3DBenchy using gen 3 (G3) resin. Scale bar is 5 mm. b) Photograph of selected AE-VAM printed 3DBenchys for gen 1 (G1) – gen 5 (G5) resin. Scale bar is 5 mm. c) Micro x-ray CT renderings of auto-

exposure VAM printed 3DBenchy models. The row label refers to the generation of resin, with G1 being fresh resin, G5 being 4x re-used resin.

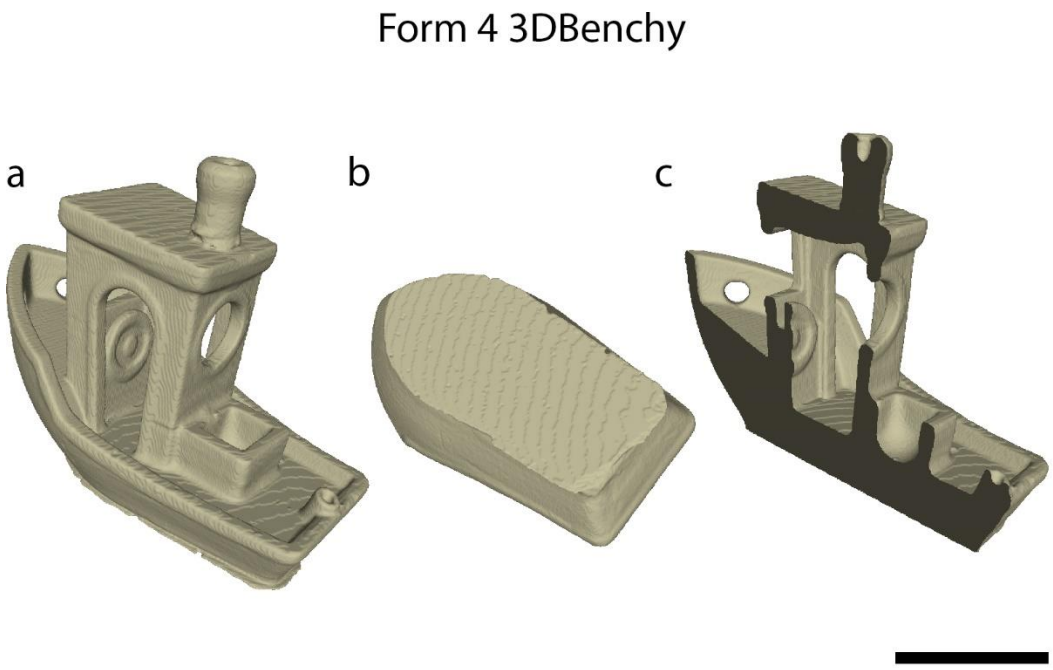

Fig. S4. a) A 3DBenchy printed with a Formlabs Form 4 3D printer. Note the deformation of the chimney in comparison to the reference model, VAM print and Asiga PRO4K print in Figs. 3a,b,d. b) Underside of the same print in (a), showing the lack of the blind hole and underside lettering that is in the reference geometry and VAM print (Fig. 3). c) Cross-section of the Form 4 3DBenchy. Note the rear flagpole holder is filled it, the rear blind hole is not present, and the chimney is filled. Scale bar is 5mm.

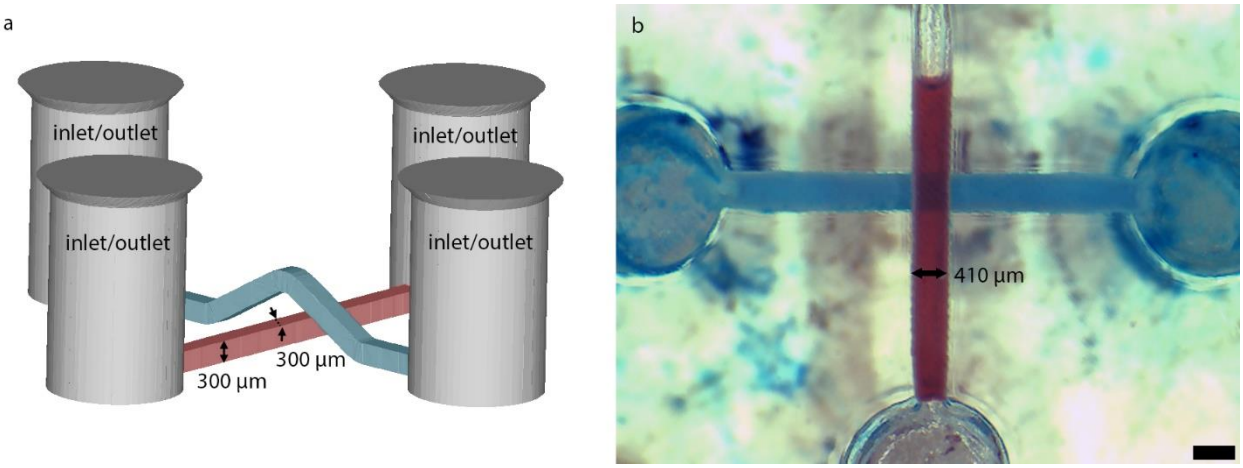

Fig. S5. a) 3D rendering of channel bridge design, comprised of an upper (blue) and lower (red) channel, each with a $300\ \mu m$ square cross section. The upper channel crosses over the lower channel with a bridge structure. b) Optical micrograph of the VAM-printed channel structure in (a). The upper and lower channels are filled with blue and red channel, respectively. The blue channel appears to cross behind the red channel due to the bridge structure visible in (a). The printed width of the red channel ($410\ \mu m$) is indicated. This is slightly larger than the design width $300 \mu m$, and matches with the smallest gap that can be consistently achieved in the calibration geometry (Fig. 2b). Scale bar is $500\ \mu m$.

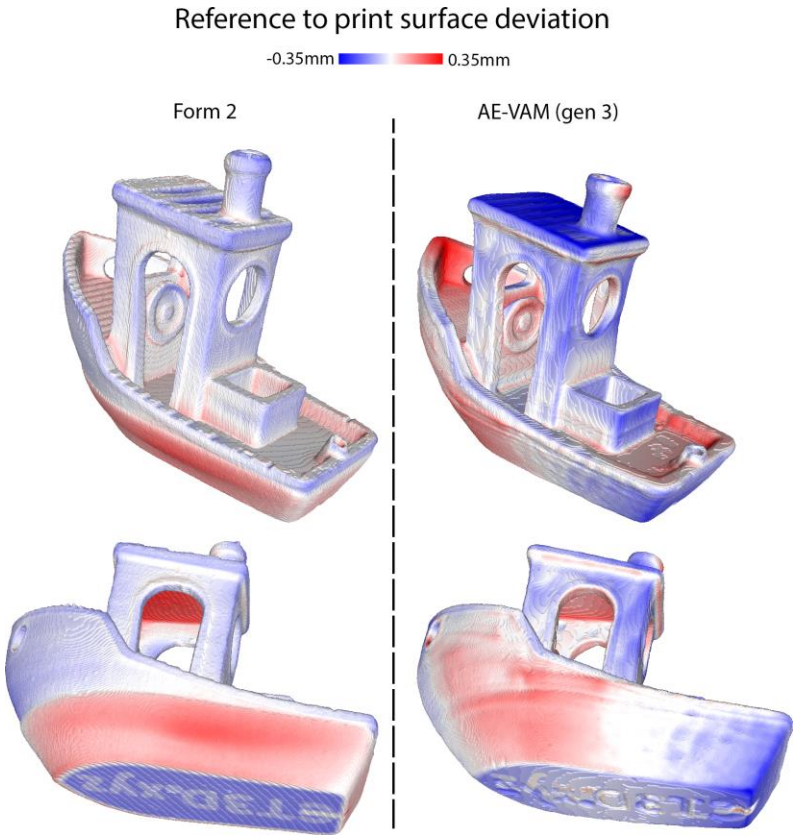

Fig. S6. Example reference to print surface deviation maps for Form 2 (left) and AE-VAM (right) prints. The RMS error for this Form 2 print (left) is 0.084mm. The RMS error for this AE-VAM print (right) is 0.096mm.

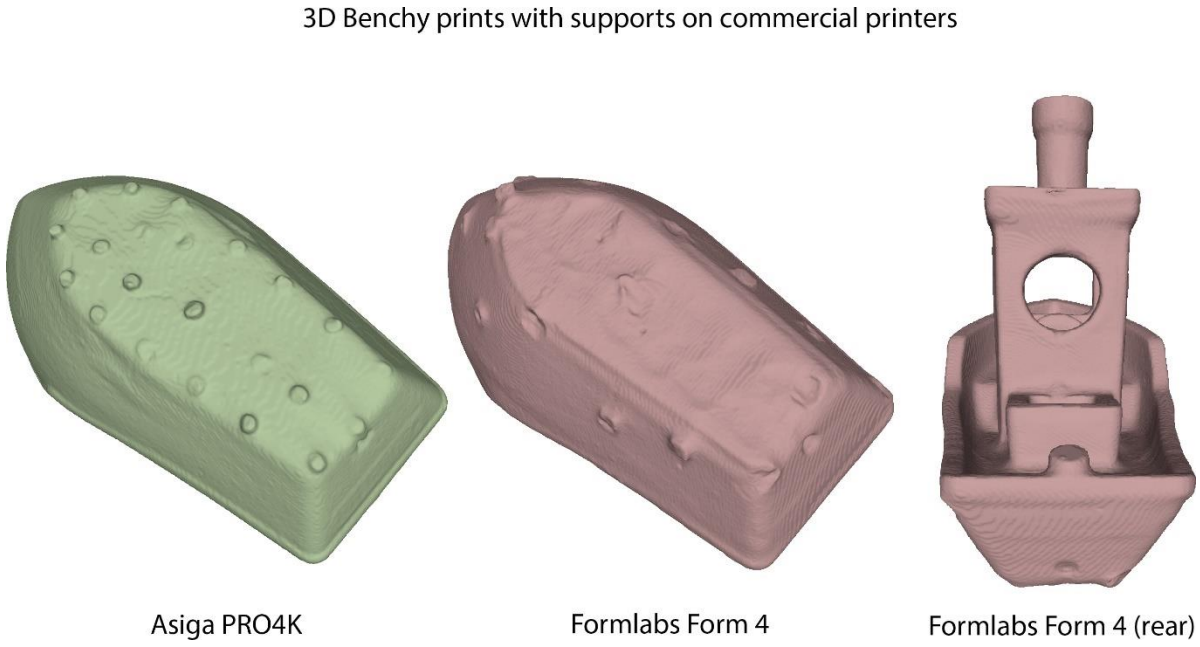

Fig. S7. X-ray CT renderings of the bottom of 3DBenchy prints using supports with commercial printers. Significant support structure artifacts remain after washing and underside text is not present. The rear of the Form 4 print is displayed to show

that the blind hole and flagpole holder remain filled, even when printing on supports at manufacturer's software optimized print orientation.

1. AE-VAM 3DBenchy print details

	Mean reference-to-print RMS (±std) [mm]	Mean reference-to-print deviation [mm]	Mean inter-print RMS (±std) [mm]	Mean print time (±std) [s]
Generation 1 resin (fresh)	0.111 (±0.004)	-0.028	0.045 (±0.011)	56.8 (± 0.4)
Generation 2 resin	0.099 (±0.008)	-0.016	0.041 (±0.009)	45.8 (± 0.8)
Generation 3 resin	0.093 (±0.007)	-0.010	0.055 (±0.011)	41.8 (± 0.4)
Generation 4 resin	0.097 (±0.007)	-0.005	0.052 (±0.011)	37.2 (± 1.3)
Generation 5 resin	0.098 (±0.009)	-0.004	0.069 (±0.020)	39.8 (± 2.4)
All generations	**0.100 (±0.009)**	**-0.013**	**0.053 (±0.015)**	**44.3 (± 7.1)**

Table S1. 3DBenchy print accuracy as quantified by the RMS deviation between reference file and print geometry, and inter-print RMS deviation, respectively. Mean values and standard deviations are calculated over N=5 prints for each generation of resin.

2. 3DBenchy print summary

	Form 2	**Form 4**	**Asiga PRO4K**	**AE-VAM (G2)**
Slicing thickness [μm]	100	25	50	67
Reference-to-print RMS (±std) [mm]	**0.081** (±0.004)	0.094 (±0.002)	0.085 (±0.004)	0.099 (±0.008)
Inter-print RMS (±std) [mm]	0.042 (±0.008)	0.062 (±0.022)	**0.036** (±0.008)	0.041 (±0.009)
Print time / 3DBenchy [s]	732	492	1644	**46**
Chimney	Partially filled, distorted.	Partially filled, distorted on some prints.	Partially filled	**Clear**
Underside Text	None	None	None	**Visible**
Blind Hole	None	None	None	**Visible**
Flagpole Holder	Filled	Filled	Partially filled	**Clear, present in 19/25 prints.**
Cabin roof overhang	Bowed	Bowed	Bowed	**Flat**

Table S2. Summary of dimensional accuracy, repeatability, and speed of 3DBenchy prints. Qualitative appearance of small subtle features is also noted. The printer with the best result in each category is bolded.

3. Dimensional test disks

Vertical Position [mm]	Mean thickness error [mm]	Thickness std [mm]	Mean diameter error [mm]	Diameter std [mm]
+6.2	-0.06	0.04	-0.01	0.02
0	-0.16	0.01	-0.01	0.04
-6.2	-0.02	0.03	-0.04	0.06
All	-0.08	0.07	-0.02	0.05

Table S3. Mean measured thickness and diameter of all G1 (N=12) and G2 (N=11) dimensional test disks printed with AE-VAM.