Supplementary Material

A   MARKET SURVEY: ADDITIONAL INFORMATION

The reference links for each item surveyed in the article is given in table S1.

Table S1. The reference links for each item surveyed

Ref	Product	Reference
Background Materials		
[1]	Fineshut KIWAMY	https://www.ko-pro.black/product/fs-kiwami/
[2]	Fineshut SP	https://www.ko-pro.black/product/fs-sp/
[3]	Flock Sheet	https://www.ko-pro.black/flocksheet/
[4]	Black Velvet	https://www.ko-pro.black/product/musou-black-fabric-kiwami/
[5]	Neewer Background	https://www.amazon.com/Neewer-Collapsible-Background-Photography-Televison/dp/B00SR28SJ8
[6]	Musou Paint	https://www.ko-pro.black/product/musou-black-paint/
[7]	Black3.0	https://culturehustle.com/collections/black/products/black-3-0-the-worlds-blackest-black-acrylic-paint-150ml
[8]	Background Paper	https://spectrum-brand.com/products/spectrum-badabing-black-non-reflective-paper-roll-backdrop-2-7-x-10m
Camera		
[9]	Sony A7RIII	https://www.amazon.com/Sony-a7R-Mirrorless-Camera-Interchangeable/dp/B076TGDHPT
[10]	Canon 5DSR	https://www.bhphotovideo.com/c/product/1119027-REG/canon_0582c002_eos_5ds_r_dslr.html
[11]	C3D CubeSat Camera	https://satsearch.co/products/xcam-c3d-cubesat-camera
[12]	NanoCam C1U	https://gomspace.com/shop/payloads/earth-observation.aspx
[13]	Intel RealSense D457	https://www.intelrealsense.com/depth-camera-d457/
[14]	Blackfly S USB3	https://www.flir.eu/products/blackfly-s-usb3/
[15]	Raspberry Pi (HQ)	https://www.electronic-shop.lu/product/182978?src=raspberrypi
[16]	Raspberry Pi (LQ)	https://www.raspberrypi.com/products/camera-module-v2/
Illumination Lamps		
[17]	Small Reflectors	https://www.nata.cn/images/download/nata_catalog.pdf
[18]	Medium Reflectors	https://www.nata.cn/images/download/nata_catalog.pdf
[19]	Godox SL-60	https://www.bhphotovideo.com/c/product/1341997-REG/godox_sl60w_5600k_60w_white.html
[20]	Low Glare Downlight	https://img.roline.ch/publikationen/grah2019_news.pdf
[21]	Apurture LS 60d	https://www.aputure.com/products/ls-60d/
[22]	Sunbrick (sun simulator)	https://g2voptics.com/products/sunbrick-solar-simulator/

B   COMPARISON OF LIGHTING POSITIONS

The objective of the analysis is to show the impact of different lighting positions on 3D objects projected onto 2D image planes that emulate those most often encountered in space environments.

b.1   Data Collection

The camera is set to position CP0. The background (BG0) is positioned 196cm away from the camera and the CubeSat is positioned in between them (56cm away from the background and 140cm away from the camera). The lighting positions LP0 through LP8 are defined in Table S2 and illustrated in Figure S1. The light setting descriptions are loosely related to terms often used in professional photography and show a wide range of possible illumination conditions (Hunter and Fugua, 1997). Due to the movement restrictions of the UR10 robotic arm on which the light source is mounted, the LP5 (Broad lighting) is achieved by setting the light to position LP0 and rotating the CubeSat to simulate the desired lighting effect. Images are captured under the three light intensities (LIL, LIH), lamp configurations (LAMP0-2) and for each of the lighting positions (LI0-8).
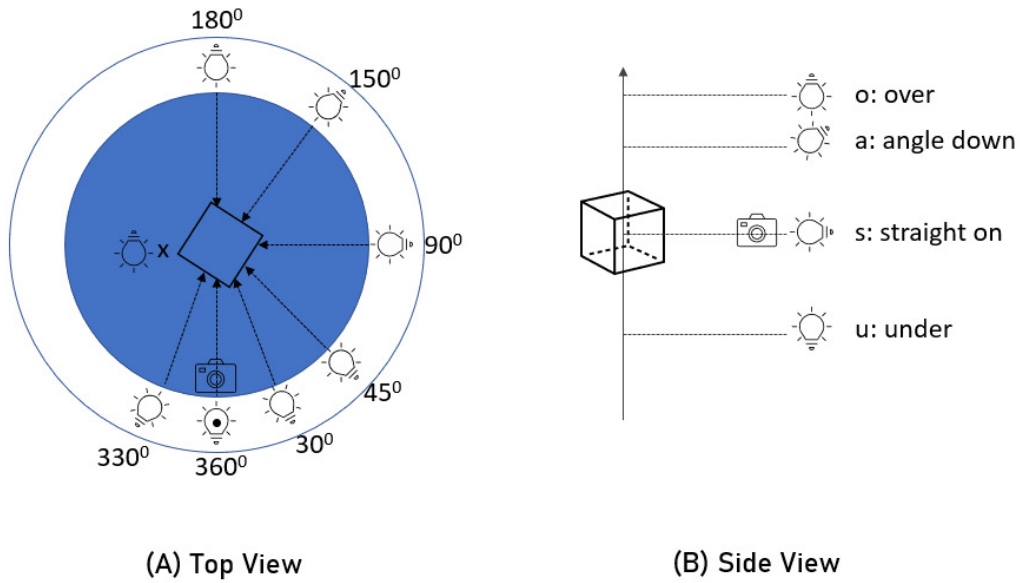
(A) Top View   **(B) Side View**

Figure S1. Camera and lighting position with respect to the spacecraft object for the comparison of lighting positions

Table S2. Lighting position labels, angles, height and description for the comparison of lighting positions. *LP5 is achieved by setting the lighting to position LP0 and rotating the CubeSat to simulate the desired lighting effect.** Denotes origin, i.e. where the CubeSat is placed.

Lighting Position Label	Angle	Height	Description
LP0	30	a	Loop
LP1	45	a	Rembrandt
LP2	90	a	Side
LP3	150	a	Rim
LP4	180	a	Back
LP5*	330	a	Broad
LP6	360	a	Front
LP7	**x	o	Top
LP8	**x	u	Under

b.2   Discussion

A set of sample images captured for positions LP0 to LP8 in show in Figure S2. The results show LP0 position to be the ideal lighting position for capturing images of highest quality. LP0 position shows both shadows and highlights of the CubeSat and as such, best represents the 3D structure of the object when projected onto a 2D image plane.
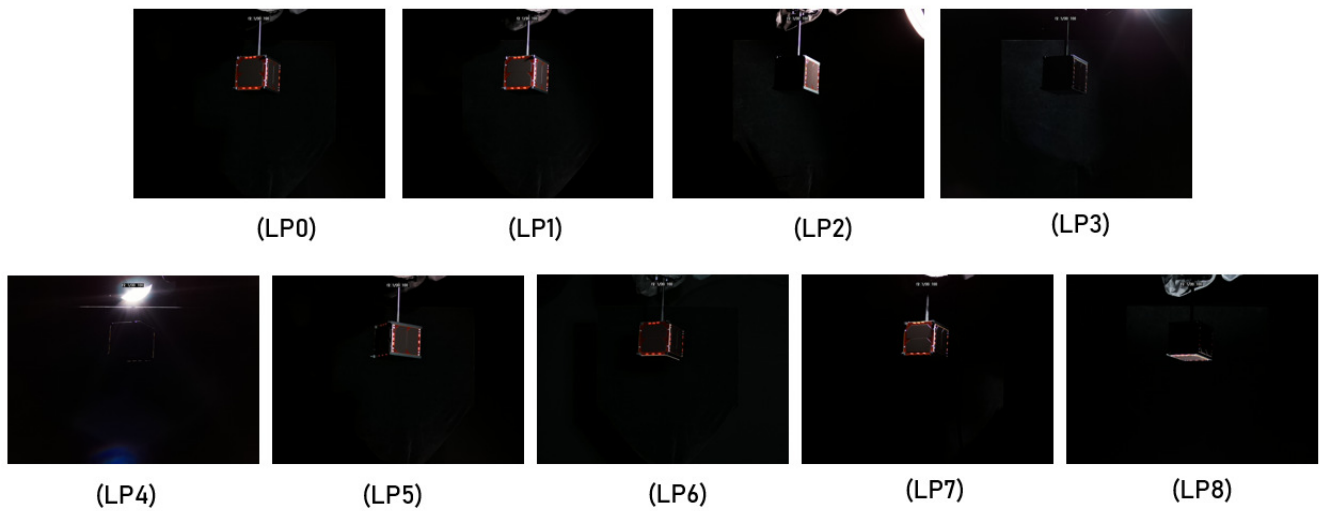
Figure S2. Sample images collected for lighting tests. The shown images are captured with the HQ camera at the LI0 light intensity setting for LAMP1 configuration.

REFERENCES

Hunter, F. and Fugua, P. (1997). *Light Science & Magic* (Burlington, MA: Focal Press)