Supplementary Figures:

Development and characterization of a low intensity vibrational system for microgravity studies

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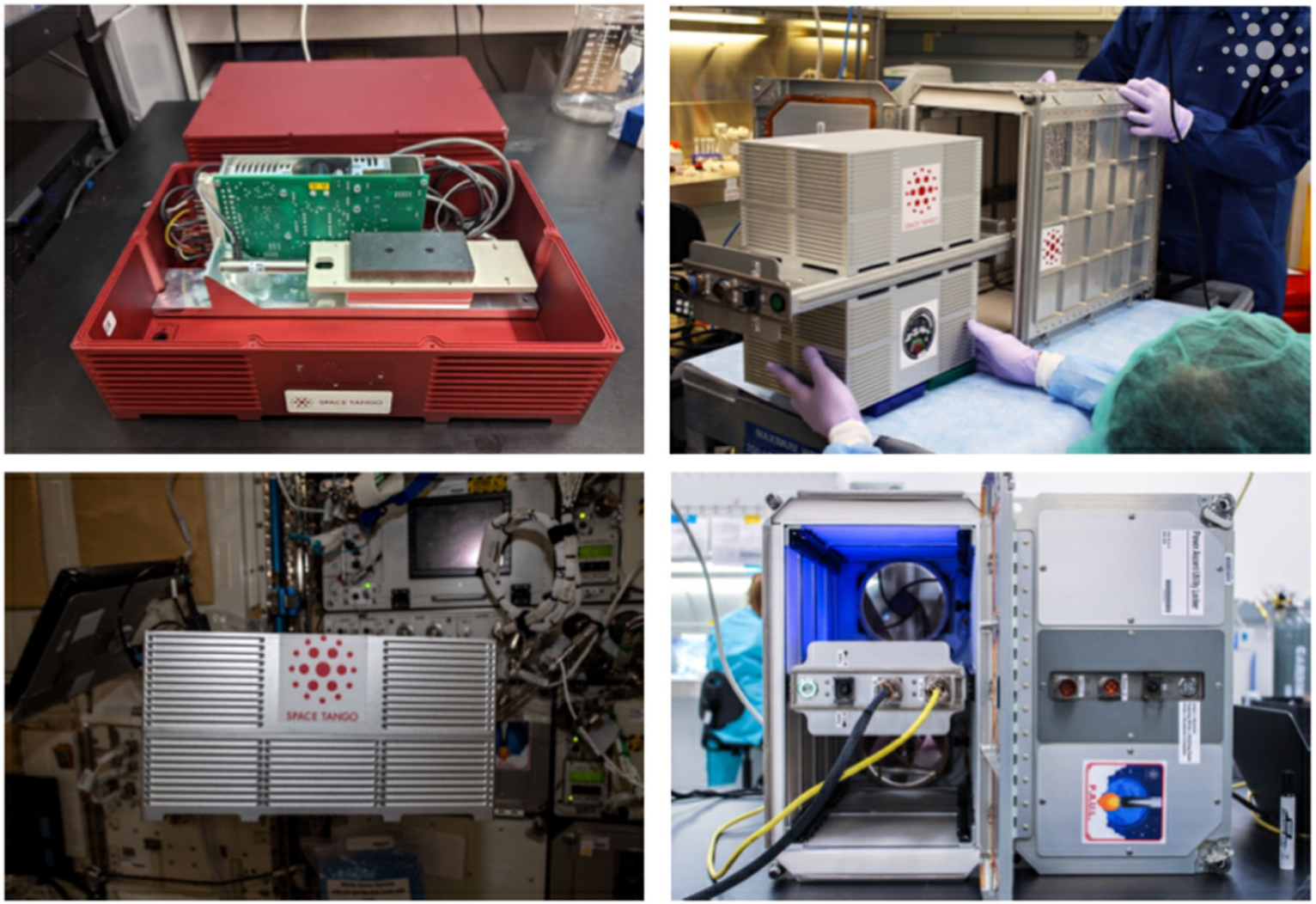
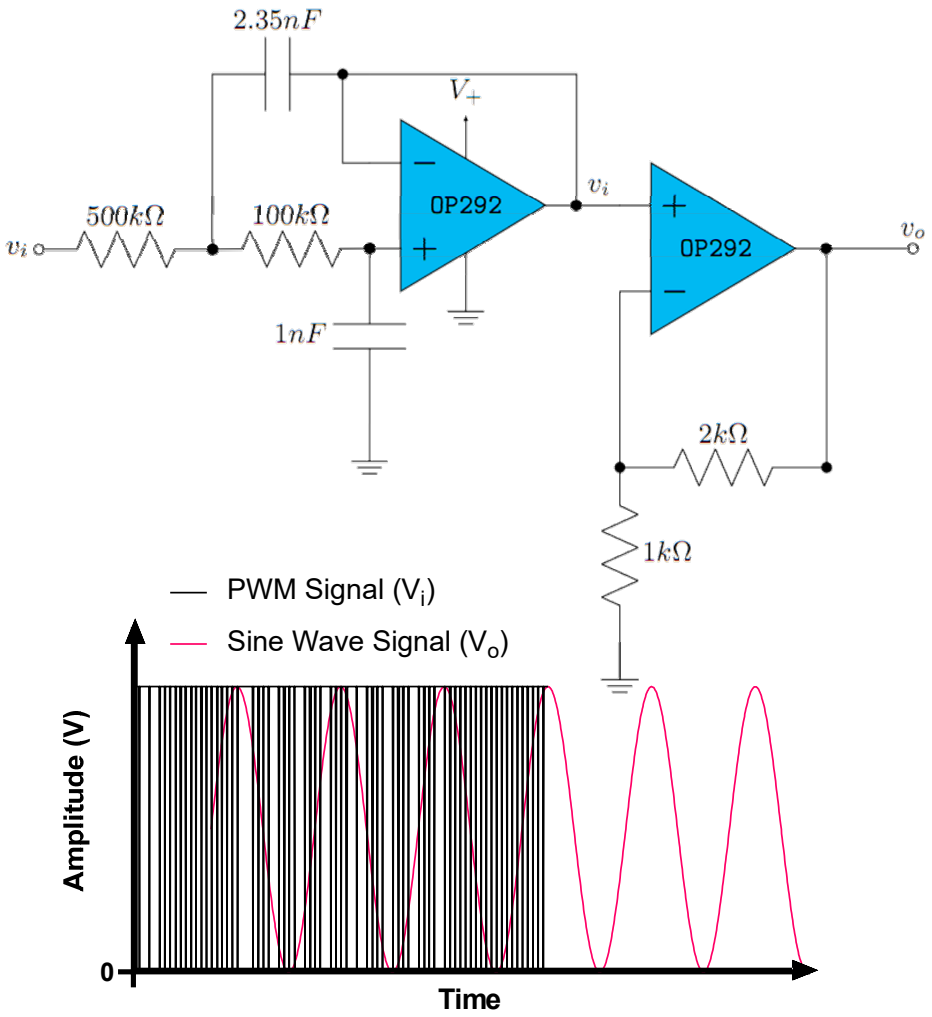
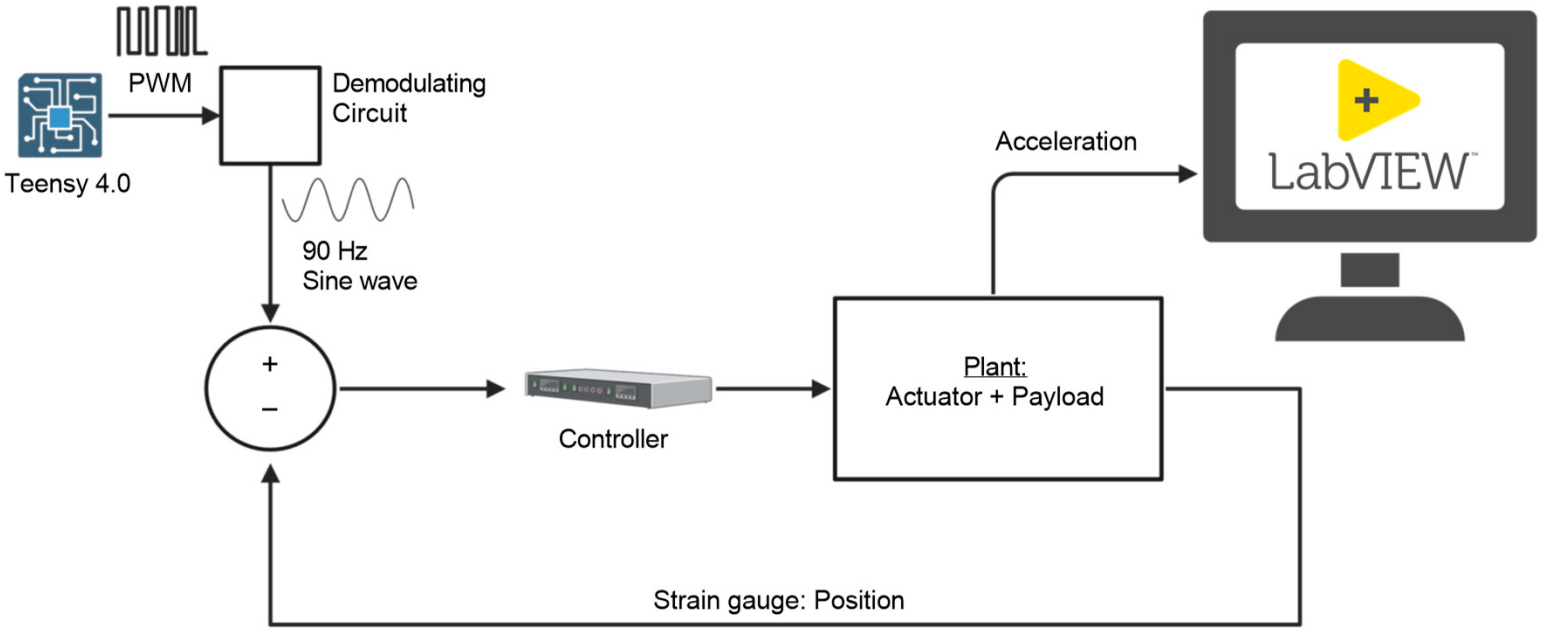


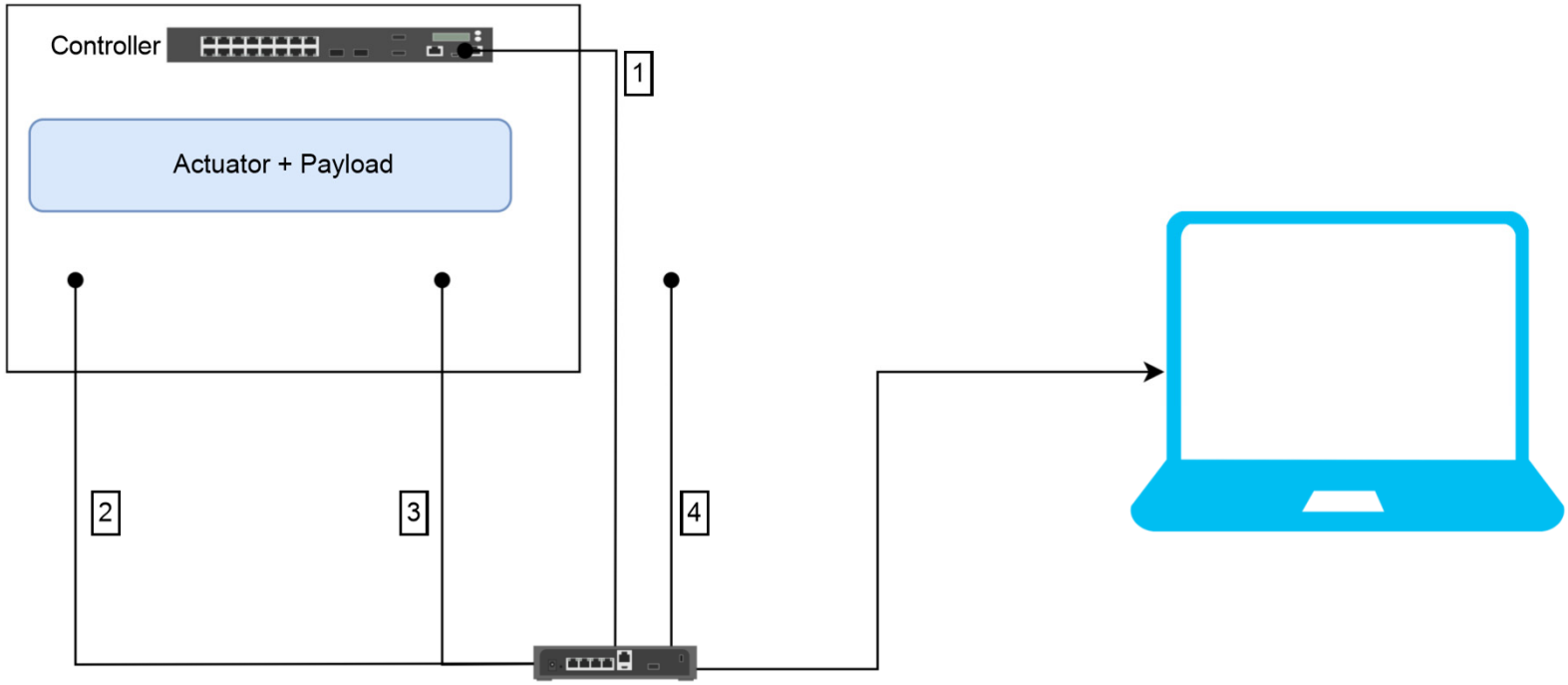
Supplementary Figure 1: CubeLab (top and bottom-left) facility that will house the vibrational bioreactor and the biological samples. The PAUL (top and bottom-right) facility designed to house and provide mechanical, electrical, and network interface from the outside



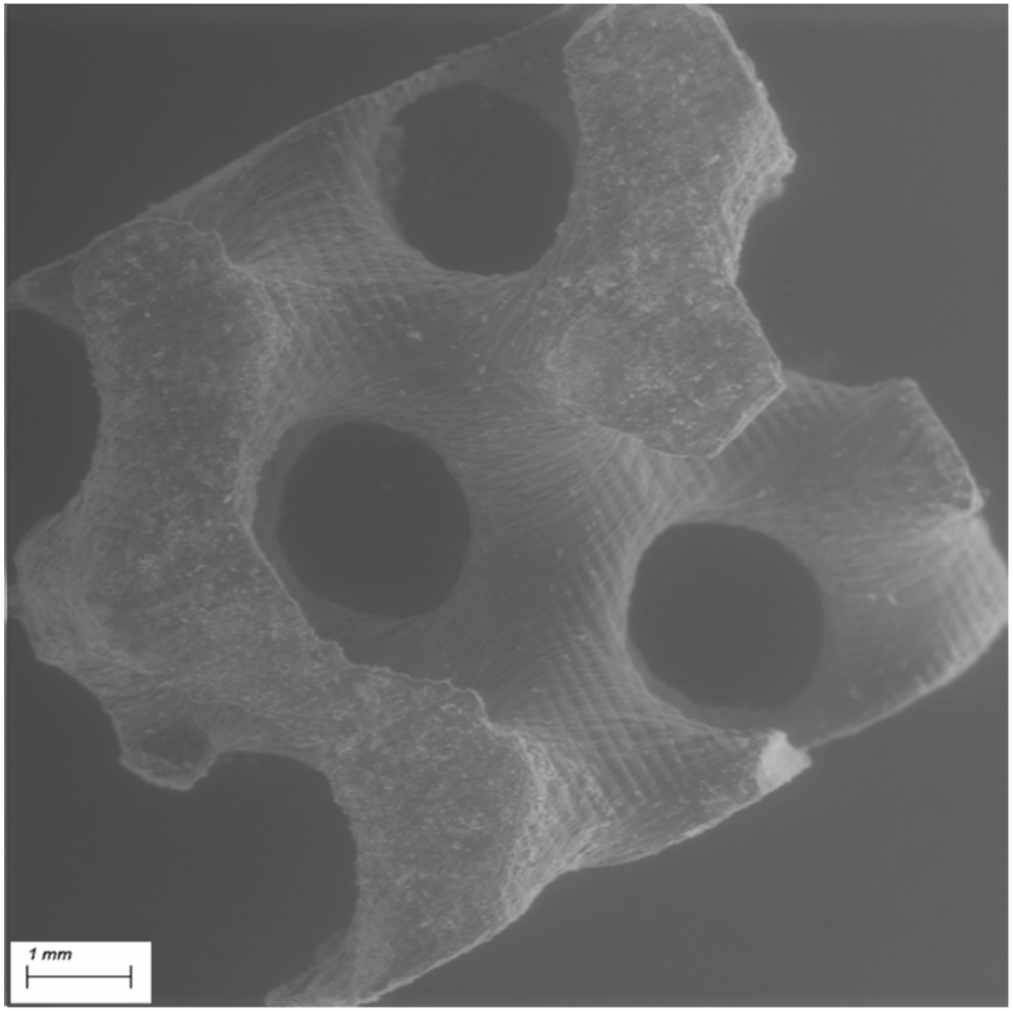
Supplementary Figure 2: Custom circuit diagram (top) to generate sine wave signal from Teensy 4.0 microcontroller. PWM signal (square wave) coming from the microcontroller is filtered by the demodulating circuit to get a sine wave output that will be used as an input signal for the LIV.



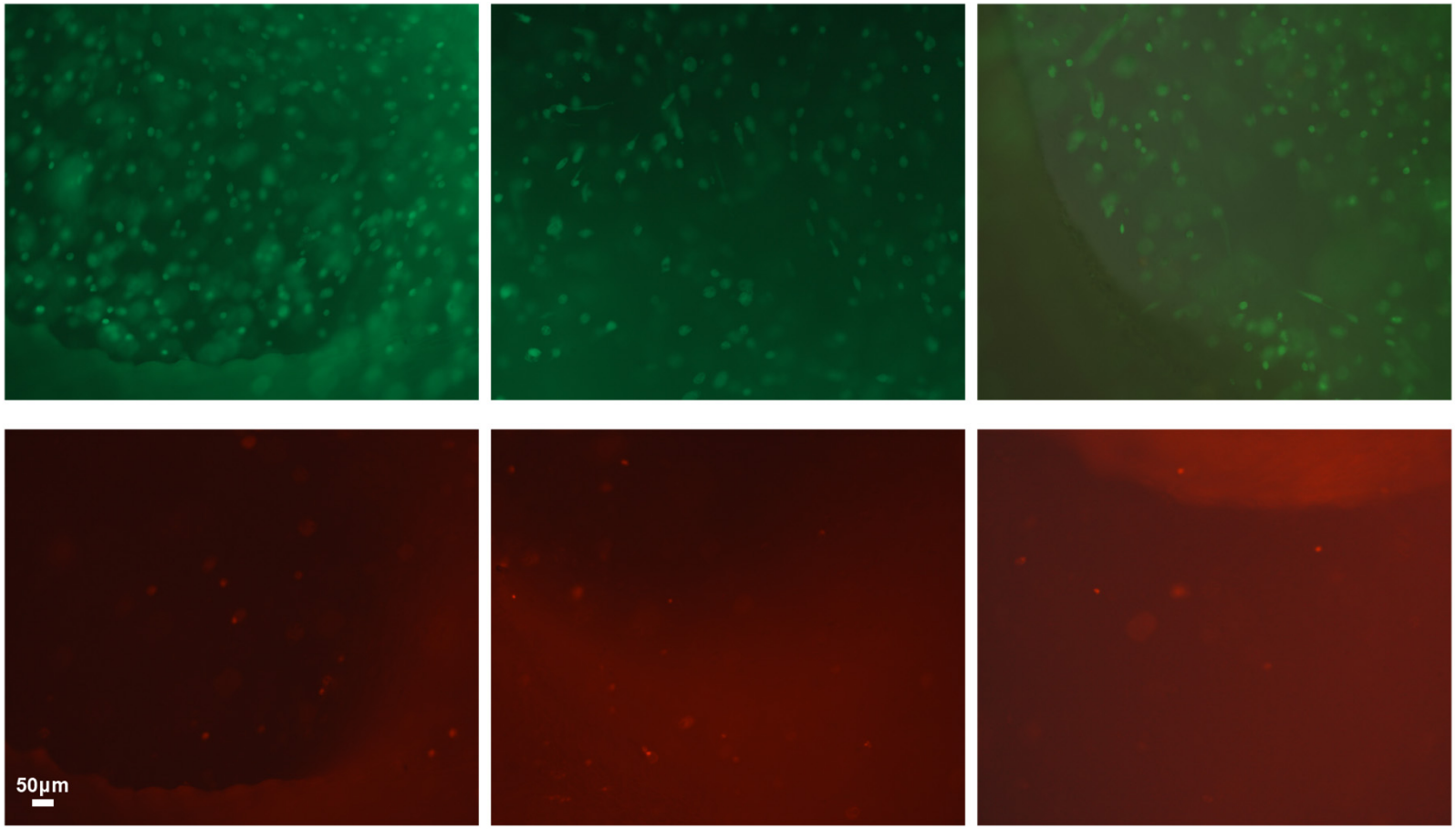
Supplementary Figure 3: Experiment schematic of the LIV regimen from signal generation to data acquisition and visualization in labVIEW



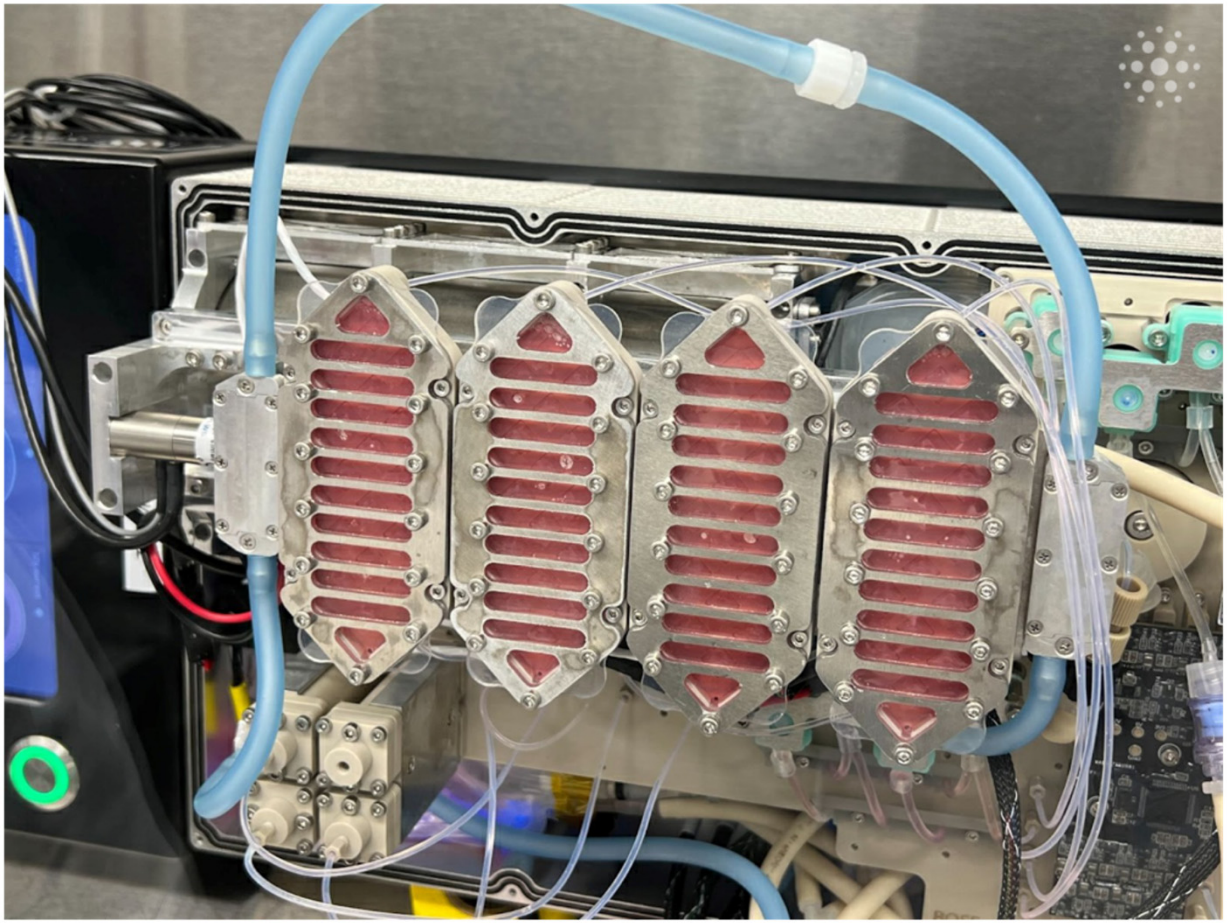
Supplementary Figure 4: Experimental setup for studying the cubelab's internal thermal field. Four thermocouples are placed in: 1. Controller 2. Cubelab ambient air 1, 3. Cubelab ambient air 2, 4. Outside ambient air.



Supplementary Figure 5: Electron micrograph of a scaffold fabricated using the BioMed Clear resin from Formlabs and were SLA printed using a Form 2 printer with a final dimensions of 5mm x 5mm x 5mm.



Supplementary Figure 6: Additional Live/Dead assay images across various scaffold locations and samples, demonstrating a predominance of live cells (green) over dead ones (red). These images further validate the biocompatibility and cell-supportive nature of the scaffold materials used in the study.



Supplementary Figure 7: CubeWells within the CubeLab module, showcasing the custom-designed well plates developed for holding hydrogel-encapsulated scaffolds. The design incorporates a secure lid system to prevent sample spillage during spaceflight, with scaffolds protected by a biocompatible PDMS layer, further sealed by a metal lid for added safety and integrity during experiments in space.