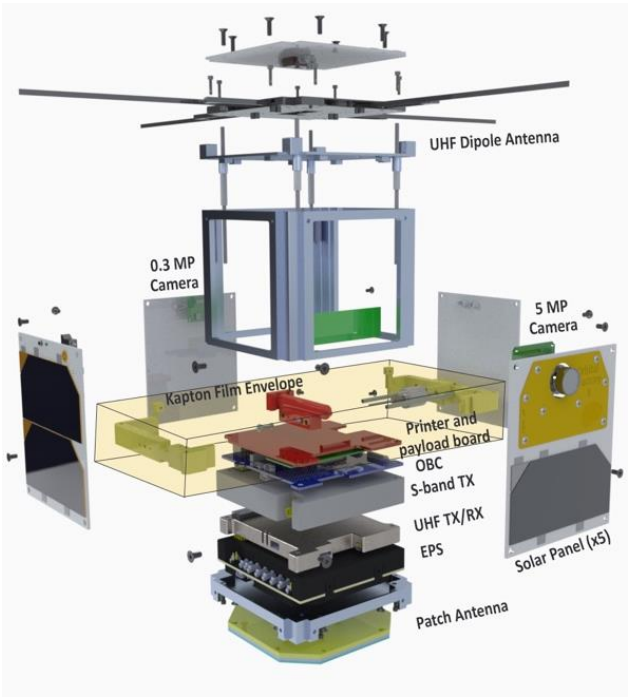
Orbital Factory 2 3D Printer Payload Description

Orbital Factory 2 (OF-2) will perform a technological demonstration featuring a 1-D printing 2-Degree Of Freedom gantry table mechanism that will deposit a conductive polymer, simulating repairing an electrical printed circuit. The material applied, Polymer Thick Film Conductive Coating E1660, was selected based on bulk resistivity, viscosity, surface adhesion and number of conductive particles, as well as curing time and low outgassing. Applied through a 0.8 mm nozzle, its physical properties are similar to honey or adhesive caulk.



Tests have determined the polymer will cure and become conductive in vacuum, 90 seconds after application to a circuit board simulating a damaged circuit. The E1660 polymer (0.6 cc total volume) will be contained inside a sealed syringe /valve / nozzle assembly, until the payload is activated and a command is received to release the ink, aka polymer. Images from a CMOS camera, and conductivity measurements, will provide observations of the results.

Figure 2 shows the isometric view and components contained of the experiment. The printer mechanism is bounded by the mounting rails, payload (bottom) PCB, and test (front) PCBs.

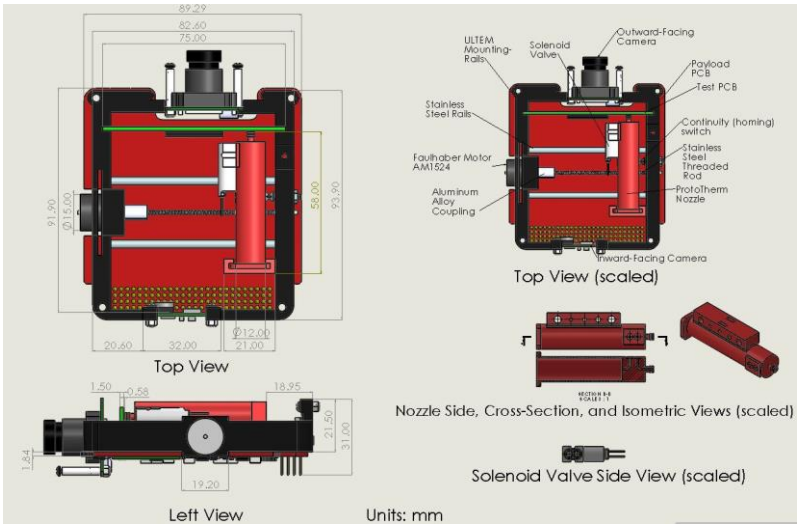


Figure 1: OF-2 Payload: Printer Mechanism

The payload assembly is wrapped in Kapton film to mitigate spread of the polymer within the satellite, should any released polymer fail to adhere to the test PCB. The adhesive nature of the polymer will cause it to adhere to the first surface it touches. Should any polymer both fail to adhere to the PCB, and by some unknown means escape from the confinement of the Kapton film, it would be contained within the cubesat by the outer walls of the satellite.

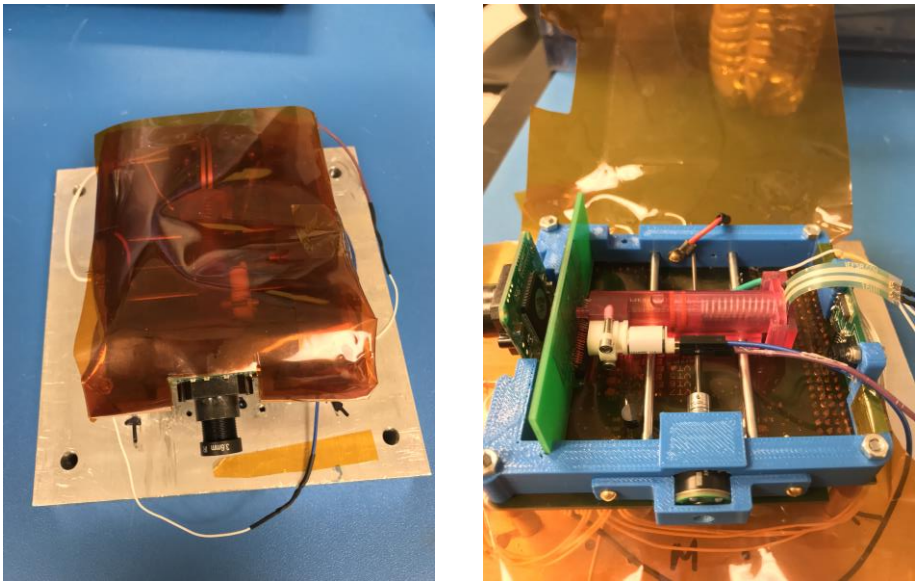


Figure 2: Printer Kapton Wrap

The printing nozzle contains 0.6 ml of E1660 polymer. The 0.8mm ID nozzle tip is sealed by the solenoid valve. Upon initiation of the experiment, a 5V opening pulse is applied to the valve, and the polymer is forced through the nozzle by static pressure of the spring on the plunger, as the syringe assembly moves parallel to the PCB surface. The diameter of the nozzle and the viscosity of the polymer determine the rate at which the polymer is dispensed. Figure 6 shows the 0.5mm proximity of the 0.8 mm nozzle to the circuit PCB to be repaired.

The experiment will be commanded to initiate after all the systems are verified operational.

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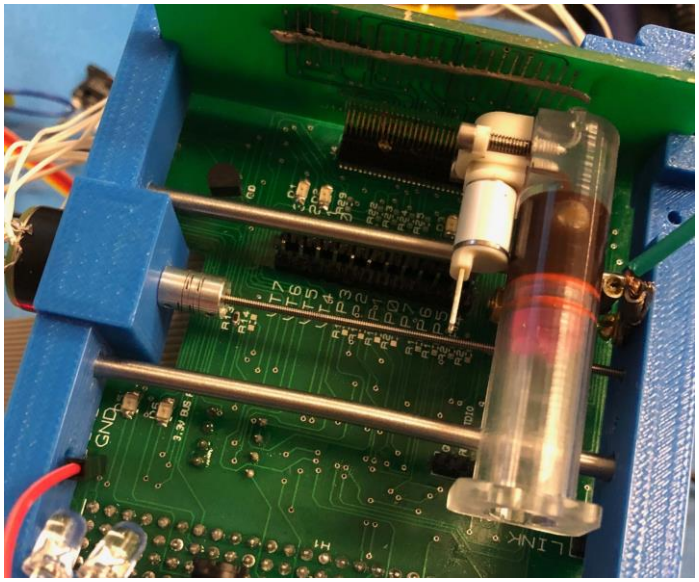

Figure 3: Printer Nozzle (valve not pictured)

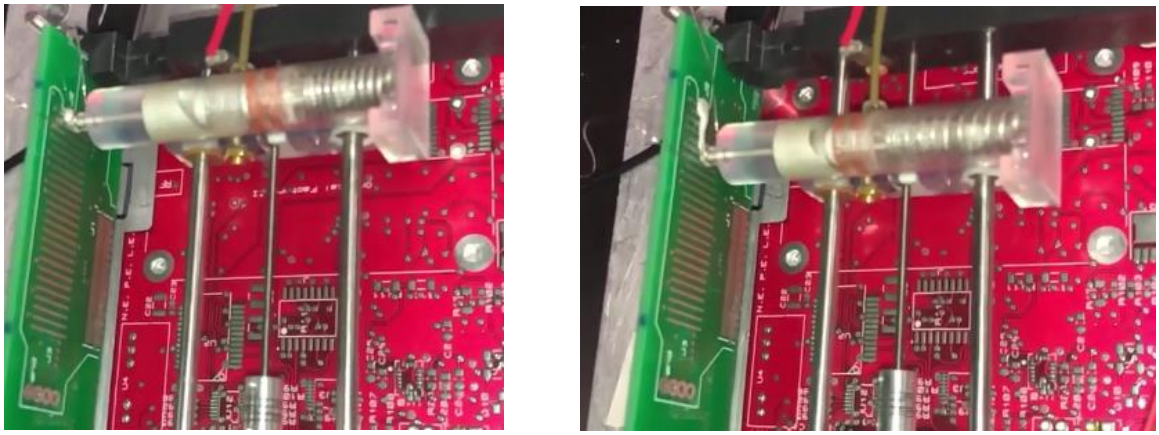
Figure 4: Ink Deployment