The large-scale development and deployment of small satellite systems in the modern aerospace sector characterizes the parallel development of new flight software and avionics systems to meet the demands of modern spaceflight operations. The flight software testing and validation campaigns of a three-layered approach:

1. **Software-in-The-Loop (SWIL):** Core flight software nodes interface with simulated sensor/actuator and state propagation nodes on a single flight computer.
2. **Hardware-in-The-Loop (HWIL):** Core flight software nodes and simulated sensor nodes are operated on separate flight computers with a UARTS/C communication protocol simulation that mimics the desired hardware components.
3. **FlatSat:**Core flight software nodes on the main flight computer interact with real hardware components distributed across an anti-static mat for probing of bus and power lines.

**Passive Thermal Coating Observatory Operating in Low earth orbit (PATCOOL)**

The PATCOOL CubeSat mission is a testbed for the performance of experimental cryogenic selective surface samples in LEO (Low-Earth Orbit). To accurately tell the Sun’s effects on the samples, the vehicle is kept zenith pointing using a custom ADCS (attitude determination and control system) combining a single D3 boom (with a tip mass) and a magnetorquer for passive 3-axis stabilization. Deadlines are currently the same as those listed above for D3.

The PATCOOL software requirements can be considered a subset of D3. For example, the boom actuator can be modified for use with one boom, the guidance tracker is currently being developed and hardware interface nodes can be interchanged, among other possibilities. This refurbishment of the D3 flight software will accelerate the PATCOOL software development timeline and prove out the overall software robustness to different mission needs and operating requirements.

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