Release / Reassembly Mechanism for CubeSat Constellation Flight

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CubeSat constellation flight will facilitate many astrophysical missions, such as inter-satellite quantum link experiments, and multi-view asteroid observations. CubeSats can be deployed as an assembly into the targe space region, then be released into a constellation. CubeSats can be reassembled again into one module after completing inter-CubeSats experiments or distributed observation, and then be redeployed for next experimental and observational tasks.

We are developing CubeSat release / reassembly mechanisms for this exciting goal. Two designs have been investigated as to make CubeSat constellation deployment possible. The first design is a vertical mechanism while the second design is a horizontal mechanism. These configurations will accommodate various payload configurations, and leave room for optical sensing instruments.

In the vertical design, a hook mounted on a cam profile turns a motor that will cause the hook to go through rotational and linear motions to grab and lock another CubeSat. The second design utilizes grooved pins and a u-clamp mounted to a rotatable base actuated by a motor driven worm gear. In both designs, we will use funnel shaped receptacles to allow redock two CubeSats approaching each other with an attack angle.

Both designs have been developed in CAD and are in the process of fabrication. Ongoing work includes packaging these mechanical designs with contributions from the electronics team and testing the CubeSat docking sequence on the internally developed microgravity test bench.