

SMALL SATELLITE MISSIONS SYMPOSIUM (B4)  
Access to Space for Small Satellite Missions (5)

Author: Mr. Steve Cook  
Dynetics, United States

Mr. Mike Graves  
Dynetics, United States

Mr. Joseph Casas

National Aeronautics and Space Administration (NASA), Marshall Space Flight Center, United States

ON ORBIT, ON DEMAND DEPLOYMENT OF NANO SATELLITES FOR EXPANDED MISSION  
CAPABILITIES

**Abstract**

The use of commercial and government satellite constellations to provide coverage persistence in imaging observations and communications is widely accepted today to enable many mission and business requirements. Generally, the high costs of such constellation missions are due to the deployment of multiple satellites which often require numerous, costly launches and sustained investments in operational ground systems for support. In many situations, the use of the traditional satellite constellation approach is an effective means to address the requirements for low cost, highly responsive short duration missions. Increased opportunities for launch ridesharing coupled with newly developed microsatellites allow the opportunity for on orbit, on demand deployment of a constellation of collaborative nanosatellites. This capability greatly open ups the trade space for cost effective missions.

A microsatellite-based “mother ship” for nanosatellites will not only enable more launch opportunities but also more valuable missions and operations scenarios. Technologies such as the Cal Poly P-POD, NASA’s CubeSat “Six Pack”, and Naval Postgraduate School CubeSat Launcher are providing the capability to launch multiple nanosatellites as a secondary payload on a launch vehicle. However, the orbit parameters are based on the launch vehicle’s primary payload and the nanosatellites are deployed in sequence into this orbit. Alternatively, with the addition of a nanosatellite launcher into a microsatellite mother ship, the mission operations possibilities expand to include deploying formations and constellations of nanosatellites. Using the propulsion capabilities of the microsatellite, the nanosatellites could be deployed into different orbits without requiring integrated propulsion on each nanosatellite. In addition, the mother ship can provide on-orbit power and communications. This service enables many mission design options such as maintaining spare nanosatellites as hot backups to replenish operational units at end-of-life, or performing software upgrades on orbit to improve the capabilities based on previously deployed CubeSats without having to wait on another launch. Finally, having an on-orbit deployment capability allows the mother ship to protect the typically-short life nanosatellites from the space environment.

Manifested on the DoD STP-S26 mission for June of 2010, the FASTSAT-HSV commercial microsatellite will demonstrate the use of the P-POD to perform an on-orbit deployment of a 3U CubeSat (NASA’s Nanosail-D), paving the way for deployments of six to eight nanosatellites on future missions. A collaborative team including Dynetics, the Von Braun Center for Science Innovation (VCSI), and NASA is developing this new “mother ship” technology for the FASTSAT-HSV microsatellite bus.