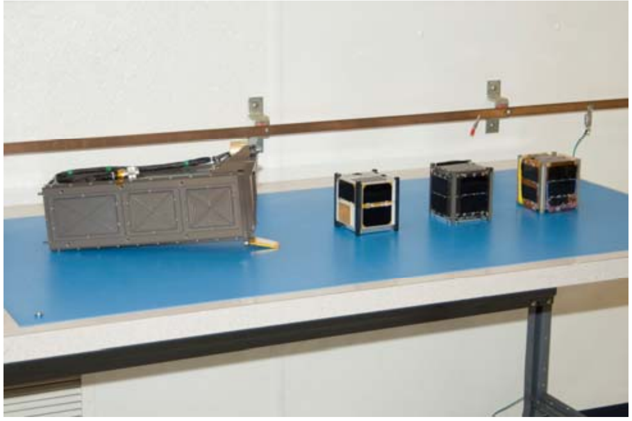
CubeSats

Three cubesats will be launched as secondary payloads on the TacSat-3 mission. The satellites, which contain their own power and data systems, are 4-inch cubes that weigh no more than 2.2 pounds each. The three satellites are placed in a Poly Picosatellite Orbital Deployer (P-POD), which is about the size of a large loaf of bread. The standard deployment system for cubesats, the P-POD was developed by the Aerospace Engineering Department at California Polytechnic State University in San Luis Obispo. After the primary satellite has been released and a collision and contamination avoidance maneuver has been performed, each cubesat will be deployed separately from the P-POD into space.



P-POD is on the left with the three cubesats flying on the TacSat-3 mission.

CP6 CubeSat

California Polytechnic State University, San Luis Obispo

The CP6 satellite's primary mission will consist of reading sensors for attitude determination and using Earth observation imagers for verification. Cal Poly's CP6 cubesat is a modified backup model of the earlier CP3 satellite, launched in April 2007. While CP3 is considered an operational satellite by the PolySat team, unreliable radio issues have prevented full operation of the spacecraft's mission-required sensors.

CP6's secondary mission is an experiment developed by The Naval Research Laboratory to measure the effectiveness of an electron collection device in space. Electron collection from the plasma surrounding the earth is a key element of an emerging concept for spacecraft propulsion that makes use of the physics principals of electrodynamics. Electrodynamic propulsion offers the prospects of enabling spacecraft to maneuver without the expenditure of conventional fuel, that is the possibility of propellant-less maneuvers. This experiment consists of three deployable devices, an electron emitter consisting of two thoriated tungsten filaments which reside at the end of a 1.8 meter rolled up steal tape and two electron collectors that are rolled up steel tapes, each 1.1 meters long. The tapes and electronics of the experiment are housed in a 1" high space on one side of a deployable door nestled around two cameras of the Cal Poly primary mission. The deployable door and rolled up tapes will be deployed at the conclusion of the Cal Poly primary mission and last for 3-6 months. The mission data will be downlinked to ground stations at the Naval Research Laboratory and Cal Poly.

HawkSat-1

Hawk Institute for Space Sciences, Pocomoke City, Md.

Hawksat-1 is the first satellite to be entirely designed, developed, fabricated, tested, and launched entirely from the Eastern Shore of Maryland and Virginia. Its primary function is to act as a proof of concept vehicle for future satellites to be developed by the Hawk Institute for Space Sciences.

HawkSat-1 subsystems include Command and Data Handling (C&DH), Electrical Power System (EPS) with Solar Panels to recharge the flight batteries, and Radio Communications with an Antenna Deployment System.

HawkSat-1 also carries a customer payload developed by a major aerospace firm. This experiment contains an external payload board which exposes newly developed materials to the radiation and temperatures encountered in the space environment. An internal payload board gathers the data and relays it to the flight computer every 20 minutes. The flight computer records and saves the data ultimately formatting it for subsequent transmission to the ground stations.

The Hawksat-1 radio checks for a compatible ground station signal every 20 seconds. Upon detecting such a signal it immediately establishes a communications link and begins to transmit an identification message followed by the mission data. HawkSat-1 automatically returns to data sampling mode once the communications link is terminated upon moving out of range of the ground station.

AeroCube 3

The Aerospace Corporation, Los Angeles

The Aerospace Corporation's AeroCube-3 CubeSat picosatellite is a third-generation miniature satellite that is significantly more complex than its predecessors. It features several infrastructure improvements. The most important is a new solar power subsystem that replaces the subsystem that failed on AeroCube-2. The AeroCube-3 will demonstrate a two-axis sun sensor and an Earth sensor. These are important pieces of a future guidance, navigation and control system. AeroCube-3 incorporates a two-foot diameter semi-spherical (8-panel) balloon that can serve as a de-orbit device as well as a tracking aid. AeroCube-3 uses an inflation system similar to the one on AeroCube-2. The difference in orbit life (with and without a balloon) is estimated to be from 1-3 years (depending on atmosphere assumptions) without a balloon compared with 2-3 months with the balloon inflated. A VGA-resolution camera pointing in the direction of the balloon will photograph its state of inflation.

The AeroCube-3 mission consists of two phases. Phase A occurs with the AeroCube-3 tethered to the Orion 38 motor that is the upper stage for the TacSat-3 Minotaur launch vehicle. During this phase, AeroCube-3 will measure its dynamics while on the end of a 200'-long tether attached to a tumbling object (the upper stage). A VGA-resolution camera with a wide-angle field of view will attempt to photograph the upper stage on orbit. A tether reeling mechanism inside the picosatellite can close the distance by drawing in the tether (it operates by ground command). Phase B occurs when the tether is cut and AeroCube-3 becomes a free-flying CubeSat picosatellite. In this phase, permanent magnets and hysteresis material will align the satellite with Earth's magnetic field. In this configuration, a sensor suite will sweep Earth's surface and various experiments can be performed. AeroCube-3 will store sensor data until it passes over its ground station and the data is downloaded.

AeroCube-3 was built with funding from the U.S. Air Force Space and Missile Systems Center's Developmental Planning Directorate.