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ULTRA THIN, DEPLOYABLE, MULTIPANEL SOLAR ARRAYS FOR 1U CUBESATS

Abstract

During the mission design for the first Ecuadorian satellite, the NEE-01 PEGASUS, the need arises for having a more extensive power supply to charge our already very large battery banks; calculations indicated that we will need no less than 40 of our solar cells. So the Space Operations Division of the Ecuadorian Civilian Space Agency began studying the design of a pair of ultrathin, deployable, multipanel, solar arrays, able to fold in no more than 6 millimeters height as our spacecraft was of the 1U cubesat design and the P-POD restrictions allowed a maximum clearance of 6.5 millimeters. Once in orbit each array will be 27 centimeters by 8 centimeters wide once released and deployed.

The main challenge was to simplify the release and deployment mechanism in order to fit the 6 millimeters restriction in the folded configuration, so the solution was the use of intelligent materials and the modulation of the tensile strength of polymers by creating geometries that will naturally provide the deployment force needed and the use of the solar heat to activate memory shape alloy components that will provide the rest of the deployment force needed to acquire final deployment geometry.

The result was a device that uses no mechanical hinges or power for release and deploy and it not only met the requirements but actually surpassed them and after much testing and trials they were produced in the final configuration and incorporated in the NEE-01 PEGASUS power matrix design giving the spacecraft a total of 57 solar cells for a maximum of 14.25 watts of power generation capability using our actual solar cells.