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ELSA-CS, A FOUR TIMES DEPLOYABLE SOLAR ARRAY FOR THE CUBESAT STANDARD

Abstract

CubeSat missions are becoming more and more ambitious. As payload and mission design come to be more complex, a growing market for CubeSat propulsion systems opens new doors for even more sophisticated mission concepts. More demanding missions lead to increased power budget requirements. While one of the advantages of CubeSats is the standardized container for launch, this turns out to be a limiting factor when considering deployable devices. Although most CubeSat dispensers provide more available volume with respect to the CubeSat specification geometrical envelope, it is still a challenge to fit multiple deployable arrays into a container. More than that, increasing the surface area of CubeSats using deployable arrays also influences other design aspects of the CubeSat, such as thermal control, mass, and release and deployment mechanisms. ELSA-CS is a solar array for 6U, 12U and 16U CubeSats that can deploy up to four folded panels within CubeSat specification boundaries. If a container that provides additional volume is used, ELSA-CS can deploy up to six panels. Configurations with fewer panels are also possible. ELSA-CS has been developed from the beginning to be easily adaptable to all CubeSat form factors. A four times deployable two-wing array configuration of ELSA-CS 6U features a maximum power generation at BOL of $\approx 150\text{W}$ in LEO, with a correspondent mass of only 2.2 kg and a stacked height of 7 mm. These specifications are achieved using high-performance materials. While the electrical boards and interconnections make use of polyimide-based flexible circuit boards, the structural parts are constituted primarily of carbon fibre reinforced polymers. The release mechanism is single-failure tolerant and provides a safe, reliable and low-shock deployment of the array. It allows as well for repeated testing without the need to replace parts. The system level and electrical design is being carried out by German Orbital Systems GmbH, while Space Structures GmbH is responsible for the structural design and analysis, as well as the development of the deployment mechanisms. Both companies are based in Berlin. Prototyping, testing and manufacturing has also been performed in-house. ELSA-CS project is financially supported by the Investitionsbank Berlin and the EFRE EU fund.