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DEFIANT-XL: A HIGH-PERFORMANCE GENERAL MICROSATELLITE PLATFORM FOR TODAYS SPACE MISSIONS

Abstract

As more spacecraft payloads are miniaturized, demand is increasing for small satellites with improved capabilities to support new missions while remaining both cost efficient and mass-producible. The Space Flight Laboratory (SFL) has established itself as a leader in small spacecraft development through its 25-year history of successful spacecraft missions. This paper will present DEFIANT-XL, a new SFL spacecraft bus designed to meet the demands of modern small satellite payloads for both commercial and scientific needs. DEFIANT-XL is an extension of the highly successful DEFIANT bus which has already been used for 21 spacecraft on orbit, with 8 more in active production and 9 more planned for future launch. The XL variant has overall dimensions of 40 cm by 40 cm by 58 cm and a mass of up to 70 kg while accommodating 27 kg of payload. The spacecraft accommodates a 11.7" ring separation system. Further, there are provisions to accommodate several types of commercial small satellite propulsion systems. Structurally, the bus is designed for convenient manufacturing and assembly while providing maximum flexibility for payload delivery schedules. This is achieved through having two distinct portions of the spacecraft, one for payload, and one for all other bus avionics. This allows the entire bus to be assembled and functionally tested before payload integration. Deployable solar arrays are used to provide power and are available in several configurations to support different mission orbits and power requirements. The peak power generation is 190 W with 150 Wh per orbit available to the payload. The attitude control subsystem builds on SFL's heritage components and control algorithms to deliver fine-pointing performance suitable for optical missions with a pointing accuracy of 7.2 arcsec (1) in the cross-boresight axes. Further, DEFIANT-XL can accommodate SFL's full suite of communications systems – both S-band and X-band for bidirectional communications enabling high data rate downlink. This bus has strict electromagnetic computability requirements so it can also be utilized for radio observation-based missions. Lastly, SFL heritage is used in the thermal control of the bus, maximizing the potential for passive control to reduce complexity, but still can support active thermal tailored to mission-specific requirements. In this paper, the design of the bus and key design drivers in the design are discussed. Also presented are results from the completed qualification testing of the first DEFIANT-XL bus to verify the performance of the design.