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DESIGN AND VALIDATION OF HOLD DOWN RELEASE MECHANISM (HDRM) FOR THE 6U
CUBESAT SPORT

Abstract

The "New Space" concept is revolutionizing the space industry with a focus on innovation, commercialization and more accessible technology. The use of off-the-shelf commercial components accelerates space projects, democratizing access to space, and the highlight is CubeSats. One example is the CubeSat 6U SPORT, a partnership between ITA, INPE, NASA and other American institutions. In this scientific study, HDRMs (Hold Down Release Mechanisms) were developed for the four CubeSat SPORT Booms (EFP-1, EFP-2, SIP and SLP). The general objective was to create low-cost, reliable and easily resettable mechanisms, using components accessible in the national territory and then verify these solutions through functional and environmental tests. The specific objectives ranged from surveying available components and technologies to the economic viability and scalability of HDRM production. The results demonstrated that the mechanisms were successfully designed, maintaining compatibility with the designated Booms and guaranteeing their functionality in extreme space conditions, validating the established requirements. Furthermore, the development of resettable procedures allowed repeated tests to be carried out, increasing system reliability. The CubeSat SPORT was launched as a payload on a SpaceX rocket, and following its release into space, the HDRMs were successfully operated, further validating their effectiveness in real-world operations. The analysis of economic viability indicated that these mechanisms can be applied in future national space projects, contributing to Brazil's autonomy in the field of space exploration. This study represents a significant advance for the country, enabling it to internally develop essential technological solutions for space missions and strengthening its presence on the global space scene. It is concluded, therefore, that the established objectives were fully achieved, consolidating Brazil as an increasingly relevant participant in space exploration and research.