Paper ID: 44601
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student

46th STUDENT CONFERENCE (E2)
Educational Pico and Nano Satellites (4)

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ALBISAT: 1-UNIT CUBESAT MISSION TO STUDY THE PERFORMANCE OF STRUCTURAL MATERIAL UTILIZING ADDITIVE LAYER MANUFACTURING

Abstract

CubeSats are a class of nano-satellites that use a standard size and form factor.The standard CubeSat size uses a "one unit" measuring 10x10x10 cms and is extendable to larger sizes; 1.5, 2, 3, 6,and 12U. CubeSat has a several systems and subsystems, among one of them is the primary mechanical structure which supports all the subsystems including the Solar Panel and Antenna.The prospective to develop and launch a 1-Unit CubeSat "AlbiSat" for Institut Clement Ader, Albi proposes the concept of utilization of Additive Layer Manufacturing (ALM) process to develop the primary Mechanical structure.Traditionally the mechanical structure for the CubeSat is built using machining and other manufacturing processes.The application of Additive Layer Manufacturing to design and manufacture the primary mechanical structure for the CubeSat as a novel mission concept to study the behavior and performance of the structural material in space conditions as a prospective preparation towards understanding the effects of the space environment on the material performance and structural health can help us in utilizing the ALM Process for future applications in space exploration. Aluminum 7075 and 6061, alloys which are the only two materials permitted by the CubeSat specifications so only these two materials can be used to prepare the powder to use in the ALM process. By utilizing the ALM process to manufacture the mechanical structure which has several advantages over conventional manufacturing like moving parts such as hinges which support the solar panel deployment can be printed in metal directly into the product, which can significantly reduce the part numbers as well as several other advantages like whatever we design in the CAD software we can create easily and only the material that is needed is used, there is very little (if any) material wasted. Considering our future perspective of space exploration,to explore Moon and Mars, ALM process to design and manufacture them can reduce the manufacturing costs.More complex (or, the less solid object is), the faster and cheaper it can be made through additive manufacturing.Development of the Mechanical structure for AlbiSat CubeSat project utilizing ALM process can help us to better understand the behavior and performance of the material and overall mechanical structure in the space at a low cost to simulate and analyse both Mechanical and Thermal behavior, to understand feasibility of utilising ALM process in space environment can help us to explore possibility in minimizing the manufacturing cost and time for space missions.