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FEASIBILITY STUDY ON ADDITIVE MANUFACTURING OF CUBESAT STRUCTURES

Abstract

It has been over 50 years since man first stepped foot on the moon, yet space remains accessible only to the elite class. It is so because space is very expensive. Since 2003 CubeSats have brought down the cost of satellites by a large margin but yet they remain inaccessible to smaller industries. Studies have shown that the problem of cost can be solved in three different ways:

- Reduction in Number of Parts
- Reduction in Manpower
- Faster Production

Additive Manufacturing brings a combination of all the three solutions together. Additive Manufacturing or Metal 3D printing has been proven to be very reliable in the past few years and with the developments in Manufacturing industries, additive manufacturing is now possible using aerospace materials like Titanium-64 alloys and Aluminium - 2319 alloy.

Space Resources Laboratory is a Small Space subsystem provider currently building low cost CubeSat platforms and micro-propulsion systems by utilising the advancements in additive manufacturing. The company believes the cost of CubeSat structures and micro-propulsion systems can be sliced by a large margin using additive manufacturing and change the way the space industry thinks. The company is working on the production of the world's first 3D printed CubeSat. It is supported by Cranfield University where studies are currently being conducted as explained in this paper to study the feasibility of applying additive manufacturing CubeSat structure. The structure is being designed using the Additive Manufacturing and Generative Design modules in Siemens NX with analysis and simulations being performed using NASTRAN. The study involves simulating the structure for different small satellite launch vehicle environments. A trade-off study is being performed for different materials which can be used to produce CubeSat structures using additive manufacturing considering a number of factors such as mechanical properties of materials, thermal properties, cost of production, time of production (single and mass production). The product will also be $\beta-$tested at some of UK's small satellite companies. The study is expected to be completed by early August with the completion of design, fabrication, testing and validation of the products in simulated environments.