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3D PRINTING TECHNOLOGY : OFF EARTH MANUFACTURING

Abstract

The aerospace industry though advancing at rates never imagined before, still has room for development in various sectors. Some of them include manufacturing quality spacecraft components ensuring that constraints on its size, weight as well as material durability are satisfactorily met. These constraints present themselves mainly in the light of minimizing damage caused during atmospheric re-entry. This abstract is inspired by the practice of In-Situ Resource Utilization (ISRU).

Every component has its shelf-life and exceeding the same on an orbiting platform like the ISS or any future space station demands their import from Earth. To eliminate their import, 3D printing proves to be the best possible choice to achieve the objective of manufacturing them on-board. Though this has been implemented on board the ISS, the novelty in this proposed abstract would be to employ Additive Manufacturing techniques such as Direct Energy Deposition or Fused Deposition Modelling. Powder Bed Type 3D printing can be adopted in which the metals derived from orbital debris can be crushed into a fine powder to replace conventional starter materials. The procurement of debris, though a challenge, is one that has a list of motivating factors to bring it into a reality and this proposal is yet another addition to it. As a future scope, even de-orbited satellites can be intelligently driven towards satellite platforms having these 3D printers on-board and thus recycle them by the mentioned process. The main motivation behind this abstract is to make satellites or spacecrafts self-sufficient bearing in mind the ultimate goal of bringing inter-stellar travel to a reality. Our main aim is to manufacture large scale production for deep space exploration, the size of the 3D printer has to be designed further for scalable manufacturing and it suitability in microgravity environment. The design specifications, material as well as stability of the printer and products manufactured from the same will be explained in detail in the paper with supporting

calculations, simulations and preferably experimental results.